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JOHNSON
ON
MALARIA

THE CITY OF BOSTON

FROM 1630 TO 1800

BY JOHN H. COLEMAN

IN TWO VOLUMES

VOLUME I

BOSTON: PUBLISHED BY J. B. LEECH, 1850.

AN ADDRESS

DELIVERED BEFORE THE

MEDICAL SOCIETY

OF

North Carolina,

AT ITS

Second Annual Meeting,

IN RALEIGH, MAY 1851.

BY CHARLES E. JOHNSON, M. D.

Cum nil sine ordine et lege fiat, ita vite nostræ integritas naturali lege constat, et nobis hanc investigare legem; sed priusquam ad nos spectat cognoscere ignorantiam.

RALEIGH:

PRINTED AT THE OFFICE OF THE "SOUTHERN WEEKLY POST."

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TO
WILLIAM C. WARREN, M. D.,

OF EDENTON, NORTH CAROLINA.

My Dear Sir:

I venture to inscribe these pages to you, not from their worth, for I have not the vanity to believe they deserve it on that account, but as a testimonial of respect for the talents and industry which have raised you to the front rank of your profession in our State; of esteem for the social virtues which have made you a bright ornament of society; and of acknowledgment for repeated instances of disinterested friendship and unsolicited favors.

Therefore, with every kindest wish to you and yours, believe me, my dear Dr. WARREN, your obliged faithful friend.

CHARLES E. JOHNSON.

RALEIGH, NORTH CAROLINA,
December, 1854.

1847

Journal of the

First Session

of the
General Assembly
of the
Presbyterian Church
in the
United States
of America
held at
New York
in the
year
1847

P R E F A C E .

THE following pages, with a very few additions, comprise two addresses delivered before the MEDICAL SOCIETY of the State of North Carolina, at its Second and Fifth Annual Meetings. The first was prepared and delivered in obedience to a call from the Society to be its orator on that occasion. This circumstance constitutes the reason, as well as my apology for the nature and character of the first part of this address.

The main object of the address, however, may not be, in the estimation of others, as important as I have represented it. But to my mind, the fashionable method of treating this question precludes philosophical inquiry upon the subject, perpetuates error, and verifies the following observation of a very judicious writer. "The subject of the causation of fever," says Dr. Merrill, "independent of decaying influences, has of late years gained such importance, however, that few treatises are now written upon this disease, without adverting to it, although most of what we find in our *new* books, upon the subject of fever, is taken from the *old* ones." Yet, to determine by a well-grounded study of nature, what is the cause of periodic fevers, what circumstances produce this cause, and what are the primary laws which it obeys, are important questions, which, rightly considered, in my judgment, do not belong to an impracticable transcendentalism, although they do belong, unquestionably, to one of the most difficult, and hitherto unsuccessfully cultivated portions of our science. It is true they may not be determined in this age; but there is reason to hope that, guided by an advanced physical science, our

descendants may explore the gloomy recesses of this labyrinth, and illumine what to us is now apparently so obscure. Problems as inaccessible to the ancients as these seem to be to us, have been rendered quite easy of solution, by a long and successful observation of facts and inductive reasoning. But that our successors may enter upon their work under the most favorable circumstances, it behooves us to refute error, though sanctioned by time and the authority of great names, and by careful observations to extend our insight into the real and truthful connection of natural phenomena, so that our fixed facts and actual instances may serve them as so many starting points, when they come to assume the completion of our unfinished labors.

The second address, delivered at the Fifth Annual Meeting of the Society, was in reply to a review of the first, by Dr. Satchwell, who had chosen, *of his own accord*, the presence of the Society, as a proper theatre for the discussion of this question. Thus a controversy arose, which surely ought never to have been carried into the Society, at least, with any display of feeling. However, as it was not of my seeking, and as I have, I hope, *fully and fairly* disposed of the subject, I shall take leave of it with the best feeling in the world.

Dec. 15th, 1854.

ADDRESS.

Mr. President and Gentlemen

of the Medical Society of the State :

It is with no ordinary feelings of embarrassment, and with a profound distrust of my ability to contribute anything of importance to your deliberations, that I appear before you on this interesting occasion, in the novel character of a Public Speaker. Although I consider myself one of the very humblest of the gallant few, who have stepped forward in the good work of Medical Reform in North Carolina, "to perform the tasks of hope in the midst of despair," yet I have not felt at liberty, from any considerations, however gratifying to me personally, to shrink from the discharge of the responsible duty which your partiality has assigned me.

Here I might be permitted to say many very civil, pleasant and truthful things of the Medical Profession ; nor would it be what the Lawyers call a "departure," since it is as clearly within the object of our Society to say a kind word of our professional brethren, as it is to inveigh against follies, vulgarities and vices, qualities which the pretenders in medicine have in common with some men of other pursuits. Whilst, therefore, I am compelled to ad-

mit that there are some practitioners of Medicine, who are pursuing, in a most unworthy manner, our highly honorable and truly useful profession, I wish to be distinctly understood to assert, that neither the causes which originate or aggravate their vices are necessarily incident to the profession itself. That such an objectionable state of things should exist, is, perhaps, mainly our own fault, although partly owing, I believe, to the lack of a general diffusion of useful knowledge, and to the existence on our statute book of a very pernicious law. By reference to our Revised Statutes, it will be found that all sorts and degrees of *Doctors*, from the Root and Cancer and Thompsonian *Doctors*, up to the regularly educated and highly polished gentleman and physician, stand upon the same footing, and enjoy, under the law, the same privileges and immunities as to the *Doctorate*.

It is astonishing how soon one of these pretenders will learn to cheat the public. He takes all advantages and seems to have no idea of any other *principle*. Cunningly mysterious and secret as to the sources of his knowledge and the means which he employs in the treatment of disease, he soon becomes a trading sycophant and flatterer, pandering to the pride and pleasures of the few, and ministering to the prejudices and ignorance of the many, whilst his own mind is impenetrable to a single ray of liberal knowledge,—is

“Not pierceable by power of any star.”

However, I shall not discuss here the legal privileges, nor the cherished errors of these charlatans, who are so well versed in the "gospel of enlightened selfishness" as to deny the importance of every consideration, the value of which they cannot estimate in dollars and cents. Nothing is to be made by an argument with or about them. That sort of gratuitous advertisement would only enable them the more readily to climb up into public view, confident, in their own minds, that the application of the old adage, "who shall decide when Doctors disagree," could not result to their disadvantage. It will not be expected of me, therefore, to occupy your time with any further allusion to them particularly, as I desire to make a few remarks, before I pass on to the consideration of the proper subject of this essay, in defence of the profession of medicine, the peculiar advantages we possess for prosecuting the study of it successfully, and in praise of those noble spirits who bring to the practice of their art learning, humanity, discretion and integrity, the four cardinal virtues of a really deserving physician.

It is as true now, as ever, that the services of a learned and skilful physician are of such vital importance to mankind, that if medical men will take care to be distinguished, as a body, for their humanity and integrity, their knowledge and acquirements, and their high toned gentlemanly bearing and kind offices toward each other, they will soon ensure the per-

fect confidence and entire respect of their fellow men; whilst the blunders, ignorance and misconduct of unqualified pretenders would attach to each undeserving one of them, agreeably to his worthlessness, rather than to the profession itself. Then, there would be more hope of a moral regeneration of the profession than croakers will allow is possible, because the sordid and selfish even would begin to discover that a thorough devotion to professional science and duty is the surest, if not the shortest, way to wealth and importance; and wisdom once acquired, no matter what the motives were which prompted the acquisition, will be faithfully cherished afterwards, not only for the advantages which it can confer, but for its loveliness and virtue. *The wise man*, in describing the advantages of the love of wisdom and virtue, says: "Length of days is in her right hand, and in her left hand riches and honor." But, in my humble judgment, the members of the profession, who undertake the study and practice of medicine, with a full knowledge of its relations with the various wants, pursuits and purposes of life, and with a determination to be prepared to meet these exigencies, are more deserving of praise for merit of every kind than the world is in the habit of according to them.

"A physician skilled our wounds to heal,
Is more than armies to the public weal,"

is the testimony of him, who, nearly a thousand

years before the beginning of our era, sang of Troy and her fall; and shall it be said in this so justly called age of progress, when invention is every day discovering new and unappropriated objects of interest, and opening, by experiment and the inductive method of reasoning, new fields of inquiry, in which every man may take an even start, that the humble, but earnest and truthful disciple of *ÆSCULAPIUS* is a less useful, important, and respectable member of society than he was in those ruder times? No; it cannot be. I will not believe it. The love of useful knowledge not only still exists, but even burns with a more ardent glow than at any former period of the world's history. Many circumstances conspire to produce this condition of things. It is not owing to any change in man's nature, peculiar to this age, for human nature, without doubt, has been the same in every enlightened age and nation, but results in part from the higher incentives to cultivation, and the greater rewards offered to industry. Wherever these are liberally provided, there every faculty of mind and body will be exerted to the utmost, and man will furnish the most numerous and shining examples of human perfection. Besides, along with these inducements for the ardent pursuit of useful knowledge, we are the fortunate heirs of time, who have acquired by inheritance all the advantages of the experience and wisdom which history teaches.— Mounted, as it were, upon the shoulders of those

who have preceded us in the pathway of human progress, we enjoy a more extended horizon than met their view. No narrow limits contract the sphere of our intellectual vision, but the whole boundless world is ours.

Much, too, is due to *Protestantism*, which has achieved wonders in philosophy as well as religion, and is one of the distinguishing peculiarities and most valuable characteristics of the present age. In our day, the inquirer after Catholic truth, in all the departments of knowledge, in the exact sciences and speculative philosophy, as in religion, can pursue his object with a protestant spirit. No longer the schools are connected with the Vatican, producing a degree of mental vassalage and subserviency destructive of the spirit of free inquiry. No longer the word of a Priest or Master, or a dogma of the schools, is the test of truth, but the immortal mind, whose capacity for knowledge and wisdom is increased the more it is stored with useful treasures, is left that full liberty to combat error or pursue truth, which is so characteristic of the age we live in.— And if it be the honor, as I believe it is, as well as the character, of this age, that genius and learning, not less than christian benevolence, are chiefly busy in the habitations of men, and around the walks of daily life, and that the greatest men, as well as the best, find their themes of study, and their sources of inspiration, in the moral and physical wants of man-

kind, then, in such an age, and especially in a country like ours, where we have in our governmental policy avoided the cherished prejudices and tolerated errors of long established despotism, on the one hand, and escaped from the greater evils of fanaticism, unrestrained by law, on the other, "he who will not reason is a *bigot*, he who cannot reason is a *fool*, and he who dares not reason is a *slave*." God has given man the peculiar faculty of reason to guide him wisely, and therefore safely, in the pursuits of life, and he who will not exercise it vigorously and healthfully in the progress of events, will presently find himself trodden down and crushed beneath the feet of the rushing multitude whose onward course he obstructs. Let not this be the lot of any one of us. On the contrary, let each of us, not only in his individual character and position, but likewise in his associated character, press on to the attainment of the objects and purposes of his high calling, emulating the lives and conduct of the masters in our profession, who have taken their stand, shoulder to shoulder, in the foremost ranks with those philosophers who have inscribed their names high in the temple of fame.

In the anticipation of a glorious future, the youthful and ambitious student finds the highest incentive diligently to prepare himself for the active and honorable course he means to run; and the older ones find it necessary to labor faithfully in their

several callings, that they may wear the honors of experience gracefully, and not be outstripped by their more youthful and equally well informed competitors. So, as there is no privileged road to knowledge and usefulness, every competitor, whatever his age and condition in life, who struggles to win and wear a distinction worth preserving, must undergo the same painful discipline of mind and laborious exertion. But let him who runs take heed lest he fall, mistaking the feverish excitement and fitful energy of a sanguine temperament for a true and noble ambition, and a momentary popularity for lasting renown.

Such is the study and practice of medicine, and I am persuaded that the former, if carried on with a full knowledge of its important duties and relationships with the well being of society, is ennobling in its very nature; and that the latter is honorable, and will be remunerative, when conducted under the influence of that preparation, hopefulness, and patience, which enable us to be contented with small beginnings, but keep us always ready for the gradually widening sphere of useful labors that certainly await us. We must remember though, if we hope to succeed, always to have some good object or useful purpose in view; and even in our moments of relaxation from the severer duties and arduous labors of our profession, not to turn exactly into the "primrose path of dalliance," but endeavor to cultivate an

acquaintance with those kindred sciences, which develop the mental faculties, and a taste for polite literature which gives them harmony, and to acquire a christian spirit, that we may have it in our power to contribute to the refinements as well as happiness of the social circle. This course of mental gymnastics will not only enable us to investigate with facility and to scrutinize the advantages and disadvantages of all the facts and theories, which are continually coming out of the prolific laboratories of medical Philosophers, but likewise to discharge the onerous duties of our profession more as a pleasure than as a task.

" 'Tis not for mortals to command success
But we'll do more, Sempronius,—we'll deserve it."

LORD BACON regarded the science of medicine with the greatest interest. He aimed at the relief of "man's estate," and this he believed was to be accomplished as well by mitigating human suffering as by multiplying human enjoyment. The study, therefore, of the *to kalon* and *to eidolon* of the old philosophers, however well calculated it may have been to sharpen the wit or refine the rhetoric of the schoolmen, contributed but little, according to the views of this great man, to alleviate the pains or lessen the burdens of suffering humanity. Considered in relation to these great objects, he regarded the science of medicine as the most important department of know-

ledge, because it was capable of conferring the most desirable benefits on mankind.

In this connection, too, it will not be improper to elevate our thoughts and recollect that "the great physician of the soul did not disdain to be also the physician of the body."

How gratifying to the mere philanthropist and physician are the views and opinion of BACON!—How cheering and sustaining to the enlightened, laboring physician, who is at the same time a christian man, to know, that in some degree, at least, he is following the example of his *Divine Master*!

Again; the dangers the medical man encounters, and encounters alone, unsupported by the emulous spirit and confidence of numbers,

———— "All the while
Sonorous metal blowing martial sounds,"

are as much greater than those of the soldier in the battle field, as the calm deliberation of high purposes and conscious rectitude is superior to the mere enthusiasm of excited courage. Aye, and if he falls, as he oftentimes does, fighting with deadly disease, in his lonely walks amidst pestilence and famine, no funeral honors attend upon him, no public provisions await his family. His is the honor only to have acted well the things that belong to the sad realities and pressing necessities of human life—his the honor to have been a co-worker with those great and good men, by whose constant toils, and energetic labors

and self-sacrificing spirits, mankind have been ever blessed! Hence it is with some assurance, although with an humble spirit, I assert, that the diligent and enlightened pursuit of so honorable a calling as ours, for honest purposes, is faithfully to serve God.

But I must turn from this agreeable theme, and the further elucidation of it, inviting as it is, and direct your attention to the proper subject of this essay, in which I propose to discuss the doctrine of

THE MIASMATIC ORIGIN OF DISEASE.

The acquisition of as complete and perfect a knowledge of the causes of disease, as may be attainable, is so obviously useful to the general practitioner, that it will not be necessary for me to insist upon it here; for, although the nature and seat of the malady be equally well known, and the method of treatment thoroughly understood, it is nevertheless of great importance to be able to refer to its cause, which, indeed, after giving rise to the disease, may still continue to operate injuriously by its presence. Now, as this is especially true of that class of disorders, commonly denominated malarious or miasmatic diseases; and as these diseases and their causes should be particularly objects of study and inquiry with many, if not most, of the physicians of North Carolina, I shall assign no other reason, because I believe I can adduce no higher one, for making their Etiolo-

gy the subject of this communication. On the other hand, I do not mean to be prevented from expressing my opinion in the premises, because it is too commonly the case, that he, who undertakes to direct the professional or public mind to objects of etiological reform, is more apt to be considered a visionary theorist, than a zealous and intelligent advocate of sanitary improvements. Nor shall I bring forward, just now, any other theory to explain these phenomena, as an excuse or apology for what I have to say in opposition to the received notions upon this subject.—Entertaining, as I do, the firm conviction, that the first important step in a practical investigation is the removal of any error with which it may be encumbered, it is sufficient for my present purpose, whatever my ultimate intention may be, to show that marsh miasm, in the sense of an exhalation from putrescent vegetable matter, cannot be the cause of disease. And, indeed, it would not be a difficult matter to bring forward evidence to prove that if, instead of sitting down quietly under the persuasion of the existence of this thing, marsh miasm, an inappreciable essence, about which they cannot agree, medical men and the civil authorities would earnestly and wisely exert themselves to discover the real nature and sources of morbid agents, the result would be an astonishing diminution of the liabilities to disease and the rates of mortality. It is apparent, therefore, in regard to this question, that I consider it one of some

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little importance, at least, to the skilful physician of the Southern States, involving, as it does, the every day application almost of the principles of practical etiology, which I understand to be the establishment of the invariable relationship, as cause and effect, of those agents or influences that are capable of producing diseases, and the diseases themselves. This, I believe, the sequel will show is not the case with miasm and the so-called miasmatic diseases.

I know that in advancing this opinion, I am impinging upon the current prejudices and dogmas of the schools, and, perhaps, upon the opinions of most, if not all, of the medical gentlemen here assembled. But, let me ask you, in all sincerity, have you not adopted, as a portion of your early professional education, your belief in the miasmatic origin of disease? Have you faithfully and philosophically investigated its claims to validity and truth, and, after due inquiry, yielded it your full credence, because you could not resist the overwhelming evidence in its favor? Or have you not unpardonably cherished an error, because it was a popular one, or because it furnished you with an easy, if not satisfactory, solution of a difficult question? Or have you not preferred to rest on a foregone conclusion, not, at bottom, really embracing any well tried fact, or established principle, rather than be troubled or disturbed about that on which you have already made up your minds? Or, acting still more culpably, and upon the well known

maxim of BOLINGBROKE, "that whilst plain truth may influence half a score of men, mystery will lead millions by the nose," have not medical men, from the days of LANCISI down to the present time, used the term miasm or malaria as a sort of convenient cloak for covering up their real want of information upon this subject, and thus hiding their ignorance from the public gaze? And is this the proper method, think you, of conducting an investigation after truth, reasonable truth, especially by those who seek it for the ennobling purpose of remedying the "ills that flesh is heir to?" Surely not. For, after all, the expression, marsh miasm, as denoting the cause of disease, is nothing more than a mere theoretical way of announcing the fact that something exists of the nature and source of which we are ignorant, for the production of these diseases, since it can neither be appreciated by our senses in their natural state, nor aided by all the artificial contrivances which ingenuity can suggest, nor traced even by the presence of those agencies which are said to be capable of generating it.

Educated to believe, with entire confidence, in the theory of the miasmatic origin of disease, it was not long after I commenced the practice of my profession in one of the paludal districts of this State, before I began to doubt the sufficiency of the facts and arguments upon which the doctrine rested.—Subsequent observations, and a more enlarged and

matured experience, have ripened those doubts into convictions, and I now regard the doctrine as a groundless assumption or pure hypothesis. Let me not, however, be misunderstood on these points. I do not mean to deny the fact, well known to every observing man, whether he be a physician or not, that a low marshy country is, generally speaking, more sickly than a higher, drier and better ventilated one. Indeed, I may observe in this connection, that so far from denying the effect of climate and position upon organic life, I am inclined to think there is some truth in the remark of a distinguished naturalist, made at a meeting of Savans in Charleston, South Carolina, a year or two ago, that he was so well acquainted with the geological and meteorological conditions of the State in which he resided, and the influences they exerted, even upon man, as to be able to decide in a given number of individuals, by their peculiar characteristics, in what sections of the State a majority of them were reared. Nor do I mean to assert, what every educated person will deny, that hypotheses are altogether valueless in every scientific inquiry. The views I wish to present, and hope to maintain, are simply these: That the greater sickness of the low lands is not owing to miasm, an exhalation from decaying vegetable matter, under certain circumstances of heat and moisture, the sense in which it is used by the schoolmen; and that hypotheses, to be of any importance in philosophical in-

vestigations, must have such a fixed and determinate value as will always render them applicable under like circumstances, and inapplicable under dissimilar ones. LOCKE says: "Hypotheses, if they are well made, are at least great helps to the memory, and often direct us to new discoveries." But at the same time, he gives us the wholesome caution, "that the *name* of principles deceive us not, nor impose on us, by making us receive that for an unquestionable truth, which is really at best but a very doubtful conjecture."

Sir ISAAC NEWTON says: "For the best and safest method of philosophizing seems to be, first, to inquire diligently into the properties of things, and establish those properties by experiments, and then to proceed more slowly to hypotheses for the explanation of them." But, lest it may be said that NEWTON had reference to the exact science of mathematics, listen to the language of Sir H. DAVY, to whose particular department of philosophical knowledge, chemistry, this subject of miasmata properly belongs. He says: "I trust that our philosophers will attach no importance to hypotheses, except as leading to the research after facts, so as to be able to discard or adopt them at pleasure, treating them rather as parts of the scaffolding of the building of science, than as belonging to its foundation, materials or ornaments." It is not my purpose, then, altogether to condemn hypotheses, but to keep them in their proper places,

to render them subordinate to the laws which should regulate all inquiries in the physical sciences. For example, to assume that miasm was the cause of disease, the existence of which is only inferred from the fact that disease prevails under circumstances totally inexplicable, unless upon the assumption of the existence of such a cause, would not be, I apprehend, an improper method of philosophizing, provided, on the one hand, we always had the circumstances present which were claimed as being capable of generating the cause itself, and, on the other hand, the disease invariably following as a matter of consequence.— Under different circumstances, that is, in the absence of either the disease or the miasm, we should have a cause without its corresponding effect, or, what would be a much worse state of things in physics, because fatal to any theory of causation, an effect without a cause.

Now, the course of nature, so far as it has been observed and is cognizable by our senses directly, or indirectly, where we have been able, by the aid of artificial contrivances, carefully to observe her laws and operations, is so uniform in respect to causes and effects, and so specific in the character of her laws, that we are bound by a correct philosophy to refer the phenomena of disease to some one or more of the appreciable states of the surrounding media, which are in any way brought into relationship with our bodies, or to intelligible internal agencies, or systemic

influences, rather than to some unknown, fanciful and inappreciable condition of the atmosphere.

It is my purpose, therefore, in the course of my remarks, to show that the doctrine of the miasmatic origin of disease does not rest on the evidence of our senses, aided or unaided, or, indeed, upon reliable evidence of any kind ; but that it falls under the absurdity alluded to above, namely, of a cause without a consequence, or a consequence without a cause.— Hence, the conclusion to which I have come, with others, that this theory is a groundless assumption, unsupported by such facts and principles as should constitute the basis of every philosophical inquiry.

In mathematics, you cannot rightfully seek, much less command, a demonstration, without a suitable basis of established facts or admitted axioms. So, every legitimate argument and philosophical investigation should rest upon facts and principles that are capable of application *under like circumstances*, in every process of reasoning by which the inquiring mind desires to establish truth. But for the very reason that *like circumstances* are absolutely necessary for the proper display of these prerogative facts and principles, it is obviously the case, that they are inapplicable in any reasoning or argument by which it may be attempted to account for the same phenomena *under dissimilar ones*.

This statement comprises the theory of induction, and if medicine be entitled to a place among the

inductive sciences, then is the principle here laid down of importance to our inquiry; for, as every investigation of natural phenomena necessarily becomes an inquiry into causes and their effects, and unavoidably leads to a series of physical laws, so every well-grounded theory of causation must have an intimate connection with the theory of induction, as practised in the natural sciences. Induction, then, gives us the right to expect that the same result will always happen from the same cause, operating under like circumstances; but it is of the very essence of this inference that the similiarity be first shown. Without it, no process of induction can be brought to a lawful conclusion, and reason, right reason, cannot be the ground of our belief.

Moreover, upon what does our idea of causation rest? Unquestionably, the uniform observance of two facts or sequences of external nature furnishes us the only evidence, *a priori*, of causes in that sphere. The conjunction, therefore, of any two successive events may very properly become the ground of our belief in their relationship as cause and effect, provided the second event has always been found not only to follow the first, but the second must never have been observed without the first preceding it.

MILL, in his admirable treatise on causation, defines "the cause of a phenomenon to be the antecedents upon which it is invariably and unconditionally consequent." And again: "Invariably sequence,

therefore, is not synonymous with causation, unless the sequence, besides being invariable, is unconditional."

Inconsiderately viewed, this absolute law of causation, whose property and requirements are not only invariable uniformity, but unconditional consequence, might appear to shackle our experimental inquiries, by narrowing down the proof too rigidly; but a moment's reflection will satisfy us that such is not the case, as the constituent elements of a law in the science of physical etiology, the subject under inquiry, ought not to differ from those of a law in the physical sciences generally—that is, so far as the analysis has reference to the constancy of a phenomenon, or the invariableness of a relationship. For, let it be remembered that we are investigating natural phenomena, and that every such inquiry is a search after causes and effects, and not a study of the calculus of probabilities, whose loose and too hasty system of generalization, attempting to define the complex before the simple is faithfully learned, has led medical minds, loaded with hypotheses, into endless vagaries and absurdities in their speculations upon the subjects of practical etiology. Recollect, too, that nature in her course is always uniform and certain, and that her order and economy are such as never to employ the wasteful expenditure of two separate and distinct causes to accomplish one and the same object, although in a series of events some one leading

phenomenon may be the chief cause of many consequences, and it will be clearly seen that these principles are not too rigid for a correct philosophy.

Now let us apply this Baconian process of inductive reasoning, this well established method of conducting philosophical investigations, to our belief in the miasmatic origin of malarious diseases, and see if it is well founded. Or whether, in the first place, we have not assumed a fact, which is not proved, and then built upon it a theory, which, in the next place, we are prone to apply when no induction or proper plan of philosophizing shows that it is applicable; thus making the whole operation not a process of inference or induction, but one of interpretation or deduction, which is, after all, the old Syllogistic method of teaching by authority, rather than according to the rules of modern philosophy, which has discovered the only true method of scientific investigation, by making facts the basis of inductions. To take these constructive formulas or syllogisms for the realities of experience and observation was the grand folly of the ancients. To employ them without due examination as to their real value and scientific applicability is the besetting pedantry of many moderns, especially wrangling theologians, who attempt to make the wisdom and laws of Omnipotence quadrate with their finite notions and pre-conceived opinions. Carefully investigated, then, I think it will be

clearly seen that medical men have been reasoning backwards, as it were, upon this subject of miasin, and that, too, without sufficient data to conduct them to a legitimate conclusion, whilst the rules of a just and well grounded philosophy require of them not only to prove, first, the existence of the facts of the case, and their invariable relationships, but secondly, that they shall not reason from such facts, in an explanation of any phenomena, excepting *under like circumstances*.

It might be well worth my while to dwell longer upon this important principle, if I had the time, instead of apologizing for the length of this preliminary discussion, as the neglect of it is an error very generally prevailing with medical men, as well as others, and one which leads to an exceedingly loose and careless kind of inquiry ; but I must pass on to the consideration of my subject more in detail, trusting that the array of facts and lawful inferences, which I shall adduce in support of my position, will at least awaken the spirit of inquiry in your minds, if they do not satisfy you of its entire correctness.

But, for the purpose of doing this in a somewhat systematic manner, it will be necessary for me to state clearly, first, what is understood by the word miasm or miasmata, in the sense in which it is used by those who invoke its aid in the causation of diseases ; and secondly, to demonstrate the fallacy of the doctrine, by showing *we have no satisfactory proof that the mor-*

bific cause of what are called miasmatic diseases arises from vegetable putrefaction.

Under the first head, I shall make a few pertinent extracts from different authors, to show the sense in which the word miasm or miasmata is used, and what is understood by them to be the source of this febrific agent. These might be multiplied without number, but as there does not prevail much difference of opinion among the miasmatists upon this subject, it is quite unnecessary.

BANCROFT informs us that a humid soil, abounding in vegetable remains, and acted on by heat, the range of which is from 45 to 100 Fahrenheit, is the most favorable for the extrication of miasmata.

Dr. CHARLES CALDWELL, of Transylvania University, in a prize essay upon the subject of miasm, expresses the following opinion as to the disease producing properties of decomposing vegetable matter: "Is the city commercial, and situated on navigable water? Let not the wharves be built entirely of wood. Their facing, at least, should consist of stone or brick, else they will become, in time, masses of dissolving vegetable matter, and abundant sources of febrile miasm. That the cities in the United States suffer in their health from this cause, cannot be doubted. Piles of decaying timber, alternately wet and dry, and exposed to the ardor of an American summer sun, must produce malaria as certainly and as na-

turally as the influence of spring promotes vegetation, and the rigors of winter suspend it."

Dr. EBERLE, article miasmata, assures us that, "Whenever vegetable matter meets with sufficient heat and moisture to cause it to enter into humid decomposition, there miasmata will be evolved," &c.

CLYMER, in his "Treatise on Fevers," declares: "Whatever its constitution or essence may be, it at any rate appears evident, that, in order to its production, there must be present a certain quantity of moisture, vegetable matter in a state of decomposition, and a warm temperature."

Professor Wood, of the University of Pennsylvania, in his work on the practice of medicine, article miasma, observes that, "So strong indeed is the evidence of this fact, that the great mass of observers, ever since the time of LANCISI, have agreed and still agree, in ascribing the miasmatic influence, whatever may be its nature, to organic and especially vegetable decomposition."

Agreeable to ELLIOTSTON, a distinguished practitioner of London: "The exciting cause of ague, the true indispensable cause of it, I believe to be an exhalation from decaying vegetable matter;" and that "a certain degree of moisture is necessary for the fermentation and putrefaction of vegetable matter, which fermentation and putrefaction give rise to the exhalations which produce ague." Whilst McCUL-

LOCK, who stands at the head of the miasmatists, in his Treatise on Malaria, arrives at the opinion, "That the presence of vegetables or vegetable matter, in some mode or form, is necessary to the extrication of malaria; while the conclusion has sometimes been, that it is a production formed between the living vegetable and water; more generally that it is generated between that and the latter, in some stage intermediate between life and absolute decomposition; or lastly, that it is the consequence of absolute putrefaction."

From the above extracts, which have been selected without much care, it will be seen that miasm consists mainly, if not entirely, of an exhalation from decomposing vegetable matter, under such circumstances of heat and moisture as are capable of producing putrefaction.

Now, as it is not necessary for the object of this investigation that I should stop here to inquire into the slight differences in opinion amongst the miasmatists, as to the specific amount of heat, moisture, and vegetable, or organic matter, which it is necessary to have for the purpose of evolving this subtile poison,—since we may very naturally conclude, we shall have the greater product, the more material we have out of which to form it,—I shall proceed at once to show, *under the second head*, by extracts from the most reliable authors, and by adducing instances of undoubted truth, that we may have miasmatic disea-

ses prevailing in situations so totally different from each other, it is impossible, under the rules of a correct philosophy, to ascribe them to effluvia from decaying vegetable matter. In other words, that we are sometimes exempt from them where vegetation and decaying vegetable matter, together with heat and moisture, sufficient to produce putrefaction, are abundant, and then, again, have them committing fearful ravages, where there is no vegetable matter to decay, and where there is no moisture to aid putrefaction.

Dr. DRAKE, in his work on the principal diseases of the valley of North America, speaking of the Miami valley says: "The upper portions of this basin abound in wet and marshy prairies, woodland swamps, and ponds, or small lakes of pure water.—The Southern portions offer but little of either on the uplands; but in the wide valleys of both the Miamies and along all their larger tributaries every variety of wet surface was found in spring and early summer, when settlements were first made: by clearing, cultivation and draining, however, a much drier condition has been produced. At the same time, mill-ponds have generally multiplied, and two canals, one from Cincinnati to Dayton, and thence to Lake Erie, and the other from the former city to Brookville, and Cambridge, in the State of Indiana, have been excavated. In the month of June, they are annually emptied of water, and the mud accumulated in the bottoms is scraped out upon their banks." * * *

"Through the whole distance, it (the canal to Dayton,) traverses a fertile valley from one to three miles in width, abounding in diluvial terraces and low alluvial bottoms, to which the present diminutive stream bears in the volume of its waters no assignable proportions. This valley is, in fact, the obsolete bed of one of those vast river currents which once flowed from the north into the trough of the Ohio river."

Here we unquestionably have an abundance of the materials, heat, moisture, and vegetable matter, for the generation of miasm ; and yet the same writer, who has furnished us with the above description, declares : " It does not appear that the inhabitants of the region through which the canals were dug were injured by the process, or by letting in the water when they were finished ; nor have I been able to collect any reliable evidence, that the annual emptyings and cleanings out have been productive of fever."

Again, on the authority of DR. HENTON, he assures us, there is on Paint Creek, in Ohio, a mill pond covering over sixty acres of bottom land, near the village of Washington, which is generally drained off about the first of June, after having been submerged all the previous autumn, winter, and spring, and yet it was never known to cause sickness in the neighborhood.

The following facts, communicated to me by my

preceptor and friend, Dr. W. C. WARREN, respecting Dr. T. D. WARREN's mill-pond, which covers many acres of ground, and dams up the water for a considerable distance, bear directly upon this question. "In 1846," says Dr. WARREN, "this mill-dam, four miles from Edenton, was broken, by a very large fall of rain, on the 4th day of August. All the water was discharged in a few days, and left the bottom of the pond exposed to a very hot sun, during that month and September. I expected to see a regular pestilence among the negroes, who number more than a hundred, and reside within two or three hundred yards of the mill, but, to my surprise, there was less sickness on the plantation that fall, than usual.— Since 1846, the dam was broken in the summer a second time, and the pond has dried up nearly every year, during the hot months, without producing more sickness than was to be found on any other plantation of the same size in the country."

From Dr. TILTON we learn that the town of Lewes, on Cape Henlopen, Delaware, although completely surrounded by marshes, is remarkably salubrious, and a sort of sanatorium for those invalids of the surrounding country who have enlargement of the spleen and obstructed viscera, from fevers.

Pensacola bay is several miles in extent, and bounded on the West side, from the Gulf coast up to its head, with sand beach of limited extent, in the midst of which are found marshes of fresh water

covered with cypress, magnolia, sub-aquatic plants and shrubs, yet it is quite healthy, excepting near the head of the bay, where the Escambia river, coming down from Alabama, empties. Here it has been notoriously sickly always, notwithstanding the temperature and moisture are the same as they are lower down the bay, and the extent of marsh only a trifle greater.

My present object does not make it necessary for me to describe particularly the topography of the Delta of the Mississippi, further than to state, what every one knows, that it consists of alluvial deposits, with an abundant and luxuriant vegetable growth.—Such a condition of things, in so hot a climate, might, *a priori*, be claimed by the miasmatist as the very focus of miasms; but let us see what are the opinions of some distinguished medical gentlemen, themselves believers in the doctrine of the miasmatic origin of disease, upon this subject.

The inhabitants of the Balize, writes Dr. DRAKE, suffer much less from miasmatic diseases than those who reside along the rivers of the interior of Louisiana, notwithstanding vegetation, heat and moisture are as abundant at the Balize as more inland. This he and others attempt to explain, by supposing that the salt water of the Gulf waves prevents the extrication of miasmata at the Balize. The same reason is given for the comparative healthfulness of Key West; and also to explain why Fort Pike is less lia-

ble to malarious diseases than Fort Wood; but it will be seen presently from the statements of MARCHETTI, that whatever sanitary properties salt water may have in this country, under such circumstances, it has no such virtues in Italy. As to the influence of salt water in preserving the health of marshy places, MARCHETTI, in his medical topography and statistics of the Tuscan Maremma, speaking of the cause of the fever, is decidedly of opinion, that "the mixture of salt with fresh water greatly increases the intensity of the miasms, because pestiferous marshes have become innocuous as soon as the ingress of salt water has been prevented." He gives instances of this fact,—one in particular. Near Viareggio, a nice and pleasant little town has sprung up, and is used as a retreat, or watering place, in those very months when it was formerly, or before the salt water was shut off from its marshes, almost pestilential. In a word, he insists that the cause of fever in the Maremma is an emanation from decomposing animal matter in the marshes, and that the "humidity of the atmosphere, vegetable decomposition, and changes of temperature, are only auxiliaries, as these conditions are to be found in districts not subject to intermittent and remittent fevers."

Dr. EBERLE, one of our standard writers upon such subjects, confirms this statement of MARCHETTI, upon the opinion of MONFALCON, and his own observation. He says: "A mixture of fresh and salt wa-

ter in marshes appears to enhance the copiousness and virulence of miasmata to a very obvious degree.”—“It is a singular fact,” says the Doctor. “that the water of the sea is much more apt to enter into putrefactive decomposition than fresh water ; and this, no doubt, depends on the great quantity of organic matter which it contains.”

But to return to the delta of the Mississippi.—Fort Pike is thirty-five miles Northeast from New Orleans, and situated on the Island of Petites Coquilles. This Island, elevated about two feet above the Gulf, enjoys a rich productive soil, composed of shells, argillaceous and vegetable matter. It is washed on one side by the waters of Pearl river, and intersected with numerous bayous and marshes, and has pools of stagnant water, but notwithstanding these inviting circumstances, it has never been visited by yellow fever, and autumnal fevers even, are very scarce.*

Fort Wood is seven miles from Fort Pike, and situated on the south side of the channel, Chef Mentieur, one of the connecting Straits between Lake Ponchartrain and Lake Borgne. In its rear, there are some cypress and fresh water swamps of limited extent, which are annually replenished by rains with fresh water, like the same character of swamp and marsh in the rear of the “coasts,” from New Orleans to Bayous La Fourche and Plaquemine. This situa-

* Army Statistical Reports.

tion is decidedly insalubrious, according to the same authority, (A. S. Reports,) which makes Fort Pike comparatively healthy; and Dr. DRAKE and others endeavor to account for the difference, by the presence of salt water in the swamps of the last mentioned place. The insufficiency of this explanation, I have already denied upon competent authority; but even if it were true, the difficulty would still remain of accounting for the healthiness of the "coasts," as they are called, or banks of the Mississippi, from New Orleans to the outlets of Bayous La Fourche and Plaquemine, which the swamps and marshes about Fort Wood closely resemble, and which Dr. DRAKE assures us are peculiarly exempt from autumnal diseases.

Dr. Cartwright, a gentleman of great distinction, in an article in the *Western Journal of Medicine and Surgery*, vol. 1, is reduced to the necessity of attributing health preserving properties to the water lily, (*Jussieua Grandiflora*,) to save himself from the confession that there is no truth in the miasmatic hypothesis. He says: "The country immediately north of the line bounding the growth of the floating plant, (which is about the 30 deg. north latitude,) like that south of the 30 deg., is alluvial, contains lakes, swamps and stagnant water, is covered with nearly the same vegetable productions; but its atmosphere is evidently insalubrious, its stagnant waters impure, its inhabitants sickly, and human life of short

duration, while the country of the aquatic plant, immediately south of it, contains a wholesome atmosphere, pure water, healthy and long lived inhabitants." In some situations, within the region of the floating plant, where the Doctor thought, if the country contained sickly spots anywhere, they richly deserved to be so considered, he found the inhabitants altogether exempt from autumnal diseases.

In regard to the value, however, of this theory of Dr. Cartwright, Dr. Drake remarks, that "it is at least an open question, as the 'coasts,' or banks of the Mississippi, from New Orleans to the outlets of Bayou Plaquemine and Bayou La Fourche, lying nearly north of the region of *Jussiaea Grandiflora*, are equally free from autumnal diseases and contain as many aged inhabitants."

Dr. Carpenter, in an article in the New Orleans Medical and Surgical Journal, "on periodicity as an element of disease," corroborates this statement of Dr. Drake, and says: "On some of the Bayous of our delta, La Fourche and Terrebonne, for example, the habitable land is limited to narrow stripes of a few hundred feet to a mile in width, which form the banks of the streams, and follow their windings, and which are surrounded, on all sides, by swamps and marshes, in some places wooded, and in others, open and exposed; yet, notwithstanding, these regions are more exempt from intermittents than almost any other portion of the State."

Here, then, we have, confessedly, an ample supply of all the materials required by the miasmatists for the manufacture of malaria; but, indeed, the country seems to be so singularly and unexpectedly exempt from miasmatic diseases, that every one is looking out for some countervailing agency, some means of neutralizing the marsh poison, which each believes must be generated under circumstances so favorable for its evolution. Each learned Doctor has his own peculiar views upon the subject, whilst the common people generally say it is owing to the prevalence of sea breezes; but why do not the sea breezes, felt with equal force and constancy at the head of Pensacola bay, where the Escambia river empties, and where there is one little marsh of some one or two miles in extent, instead of a whole region of marshes, preserve that locality from the reputation of being one of the most insalubrious spots on the face of the earth?*

So, likewise, in our own State, we have extensive tracts of swamp land, in which a great number of laborers are engaged every year in getting shingles.—These laborers not only work during the day in these swamps, and drink swamp water, which is greatly discolored by decaying vegetable matter, but sleep in them at night, in open huts or rudely constructed shanties; yet they are decidedly the healthiest portion of the laboring classes in those parts of the State.

*Lind and others.

Now, this cannot be owing, as some pretend to believe, to the fact, that as the swamps are not entirely cleared and drained, vegetable decomposition does not take place, because that is palpably an error. Our own senses teach us such is not the case, and that vegetable decomposition does take place to an enormous extent. The whole superstratum, which is oftentimes many feet in thickness, consists of the debris of vegetable and animal matter; for these swamps are scarcely more noted for their luxuriant vegetation, than they are for their abundance of insects and reptiles. Besides, I am informed by Mr. Redding L. Myers, a respectable gentleman of the town of Washington, who, as assistant engineer, had charge, in part, of the workmen employed upon the public lands about Pungo Lake, that they were remarkably healthy. Here, an extensive and systematic plan of drainage, by canalizing and ditching, exposed the laborers to the exhalations from the soil, under a variety of circumstances, as well upon the prairie marshes, as in the open swamps and close jungles; and yet they scarcely had any fever amongst them, or required the attention of a physician, during the two or three years they were engaged in this service.

The Antilles, Brazil, East Indies, Europe and other parts of the earth, furnish us examples of the same kind. British Guiana, with its wet and dry seasons, and extensive alluvial marshes, which have been reclaimed from the sea by a most expensive and per-

manent system of diking, together with its culture of Sugar, Rice, Indigo, &c., is represented by a writer in the British and Foreign Medico-Chirurgical Review for 1850, as "among the most healthy of the West Indian Colonies, and capable of being healthfully tenanted by European residents," notwithstanding "its wide alluvial tracts."

Ferguson says: "The town of New Amsterdam, Berbice, is situated within short musket shot to leeward of a most offensive swamp, in the direct tract of a strong trade wind that blows night and day, and frequently pollutes even the sleeping apartments of the inhabitants, with the stench of the swamps; yet it had produced no endemic fever worthy of notice, even among the newly arrived, for a period of years previously to my visiting that colony."

"The town of Kingston, in the island of St. Vincent, is so situated," says Robert Armstrong, "as to have all the elements necessary for the production of this vegeto-animal poison, heat, moisture, decayed and decaying vegetable matter, with as large a proportion of reptiles, insects and other animal matter as is found in other tropical countries; yet, strange to say, the town of Kingston is one of the most healthy spots in the West Indies. I was informed by the staff surgeon to the forces, who had long resided there, that *it was as healthy as the most favorable spot in England.*"

Brazil, too, is said to be entirely exempt from

endemics, although it has an extremely fertile soil, a sultry atmosphere, and a most magnificent profusion of vegetation of almost endless variety. This vast empire is intersected every where with navigable streams, which pour their waters through a common mouth into the Ocean, and indented along its sea coast, of more than two thousand miles in extent, with numerous beautiful and safe harbors. The Delta of the Amazon alone spreads along the Atlantic shore, on either side of the equator, to the breadth of one hundred and fifty miles, and its length from the ocean to the farthest point where the ebbing and flowing of the regular tides are felt, and where the innumerable islands and labyrinth of channels begin, is over six hundred miles. The intelligent American travellers, Kidder and Edwards, spent several years in this country, and concur in representing every portion of it, even the entire valley of the Amazon, embracing nearly one-half of this vast territory, as salubrious in a remarkable degree. The latter, Edwards, says he never saw but one case of Intermittent during the three years he remained in the country, and that he cured with a single dose of medicine.

Dr. Horner, of the United States Navy, in describing the topography of the city of Rio Janeiro, says: "The proximity of the Ocean, the great size of the harbor, the great height of the land about it, many hills, narrow streets, and high temperature,

keep Rio almost without cessation immersed in a heavy, sultry atmosphere, rendered more disagreeable by want of cleanliness and the exhalations from the ravines and marshy grounds in its rear,"—yet Rio, notwithstanding, is considered by travellers generally, who have spent some time there, as well as in other parts of Brazil, to be healthy. And Walsh informs us that for many weeks at a time, during the rainy season, there were several hours in each day when his clothes would be wet on him, and that he oftentimes put on wet clothes in the morning, which had remained wet all night; and that whenever the sun shone out, it was so intensely hot, that he went smoking along in his wet clothes, the water from which was exhaling by heat and dissolving into vapor. "Such weather," to use his own language, "in Africa, under the same latitude, no human being could bear; but not so in Brazil; no one is affected by those states of the atmosphere which are so fatal elsewhere. It has, with some reason, therefore, grown into a proverb, that it is a country where a physician cannot live, and yet where he never dies."

Dr. Dundas, in his sketches of Brazil, after giving a full description of the medical topography and condition of Bahia, showing conclusively that in that city are accumulated, in almost unexampled abundance, all the physical conditions which are considered by the miasmatists to constitute the elements essential for the production of febrile miasms, says: "Yet,

notwithstanding this appalling combination of physical, moral and social evils, universally admitted as the chief agents in producing the most extensive and fatal diseases, Bahia continued, and can, moreover, up to the present hour, boast the happy privilege of having escaped, since the period of its foundation, from every species of endemic or epidemic malady—*yellow fever, cholera, influenza, typhus and dysentery.*” He also states that the town of Bomfim, situated in the midst of a morass, and supplied with an immense quantity of vegetable and animal matters, *exuviae*, insects, &c., which are constantly acted on by the powerful influence of a tropical sun, yet enjoys the reputation of being one of the healthiest districts in Brazil. And he further states that the inhabitants of Bomfim sometimes have intermittents during the winter season, when the marshes are completely flooded, and therefore cannot furnish febrific exhalations, and when a strong S. S. E. wind, which blows directly from the ocean, sweeps over the town; but they never have them in the hot dry months of summer, when the place is reeking with the effluvia of the marshes. These circumstances induce him to believe that marsh poison has no agency in producing these periodic fevers, but that they are most probably attributable to exposure to moist sea breezes.

This opinion of Dr. Dundas derives some support from the fact that a North East wind in Batavia, which, from the geographical position of the place;

being on the north side of the island, must blow from the sea, and not over moist or malarious ground, is highly injurious to health.

Other places are likewise known to be rendered insalubrious by the moist, cold winds of the ocean, that sweep directly over them, without impinging upon malarious soil, as Tobago, and Grenada, and Edinburgh, for example, where the east wind is a very unhealthy one. But this, according to the "*robust faith*" of some of the miasmatists, Horsefield, La Roche and others, is due to the agency of miasmata which have been blown across the ocean from the fens of Holland!!

New South Wales, including South Australia, and Australia Felix, has a wet and dry season, an abundance of streams, bays, estuaries, swamps and ponds of stagnant water, and in some places, particularly about its town, a rich and highly productive soil. It is likewise subject to inundations from the rivers, and its alluvial swamps to overflow from the sea, yet, notwithstanding all these indications of a sickly climate, New South Wales is exceedingly healthy and free from endemics.*

"The island of Java," says Sir Stamford Raffles, one of the Lieutenant-Governors of that island and its dependencies, "stands on a level, in point of salubrity, with the very healthiest parts of British India, or any tropical country in the world, although

* Malte Brun and Byrne.

it abounds in a most luxuriant vegetation, and in numberless streams, cataracts and rivulets, which are tamed to the peasant's will. In the hottest and driest season, they are made to retain some of their water which the farmer directs into endless conduits and canals to irrigate the lands, which he has laid in terraces for its reception. It thence descends to the plains and spreads *over them*, shedding fertility wherever it flows, till at last, by innumerable outlets, it discharges itself into the sea."

This same system of artificial irrigation, which is so innocuous in Java, is believed by Dr. WILSON, in his medical notes on China, to be the cause of the unhealthiness of the Islands of Chusan and Hong Kong: for, in discussing this question, he says: "The meteoric influences and the aspect of the country appear highly favorable to health—what is detrimental is believed to be chiefly the wilful work of man's hands, or of perverse ignorance."

Dr. Thomas, in his remarks "on the peculiarities in figure, the disfigurations, and the customs of the New Zealanders, and on their diseases, and their modes of treatment," says: "I have not seen a case of Intermittent or Remittent fever among the New Zealanders, and Dr. Rees, who has been resident for ten years near a populous pa (village) on the bank of the Wanganui river, has never seen one either."

"It is very remarkable," says Dr. Thomas, "that in New Zealand, where the temperature is for many

months about 60 deg. Fahr., where the uncultivated land is covered with thick wood and fern, up to the very door of a New Zealander's hut—where the moisture of the climate is great—that diseases which are attributed to marsh poison are almost unknown.—Even Europeans who have lived for years on the alluvial soil on the banks of the Waipa and Waikato rivers, and in the low town of Kororarika, have scarcely ever contracted ague; and Europeans who have suffered from ague in tropical and other countries, have recovered from the malady after a few years residence in New Zealand.”

Mr. Peale, the Geologist to the exploring expedition under Captain Wilkes, in a letter to Dr. Dunglison, published in the Medical Examiner for 1843, states, that they visited situations in the course of their travels amongst the Friendly, Society, Feegee, Samoan and Sandwich Islands, where the inhabitants subsisted, in part, upon the root of the Tarro plant, which requires to be cultivated, like our rice, in shallow fresh water ponds and marshes, and where natural marshes do not occur, they are artificially constructed by the natives. He states further, that they often found their towns situated in the midst of these “Tarro patches,” which plentifully supplied the residences with musquitoes and other insects, and the stench of the marshes; yet neither the officers, nor men, nor the scientific corps, suffered in consequence of their exposure, although they were in the midst

of the exhalations from these marshes day and night, living and sleeping, owing to "the shore duties of the service, in the midst of marsh stench and musquitoes, when the days were hot, and the huts open and exposed."

Captain Wilks mentions that these Islands are hot, moist, fertile, and remarkably healthy.

On the other hand, Mr. Peale observes that almost every one of the expedition suffered more or less from endemic diseases, after their arrival on our northwest coast, that were encamped upon the Wal-lamette river, in Oregon, where there were no marshy grounds, excessive moisture, stagnant ponds, or other sources of miasm, as both the earth and the atmosphere were remarkably dry.

Dr. Hope, of Princeton, in a letter to Prof. J. K. Mitchell, of Philadelphia, describes the Island of Singapore, which lies within the tropics, and abounds in streams, marshes, ponds and pools of stagnant water, with its jungles and a most luxuriant vegetation in many places, of astonishingly rapid growth, and equally rapid decay, as being very rarely visited by fevers of any kind, and when they did occur, were from "imprudent exposure to fatigue or the sun."—"Singapore" says the Doctor, "is considered a kind of Sanatorium for the oriental invalids, who go thither, from every quarter of the eastern world, to escape from malaria or to recover from chronic diseases."

The Island of Mauritius, in the eastern hemisphere, all writers concur in representing as strikingly like Jamaica, "so far as regards temperature, rain, physical aspects, and diversity of climate." It is in the same latitude also, with the exception of being south of the line, yet it is perfectly healthy, and, as Major Tullock informs us, "so far as can be ascertained from the statistical returns of the island, the climate does not exert any prejudicial influence on the health of the resident white population," whilst Jamaica is a notoriously sickly place.

It is likewise a well ascertained fact, that the extensive marshy grounds on the South West coast of Ceylon, between Negombo and Galle, do not render that district of country insalubrious; while it is equally certain that many of its mountain ranges on the opposite coast are remarkably sickly.

In Ireland, emphatically a country of swamps, bogs and ponds, the inhabitants in the linen manufacturing districts rot their flax in dead water ponds and ditches, thus filling the whole atmosphere with the effluvia from this mass of decomposing vegetable matter; yet, Ireland, even, under such favorable circumstances for the production of miasmata, is not subject to endemics of intermittent and remittent fevers.

Dr. Bell, in an article "On miasm as an alleged cause of fevers," in the 11th vol. of the Philadelphia Medical Journal, says: "The inhabitants of every

Dutch house ought, from the above creed, to be attacked annually with intermittent fevers, since to each is attached a summer house, situated immediately over a small stagnant canal, covered with vegetable remains, and exposed to the sun's rays.—Here, hours, especially in the evening, are spent by the family, without the members of it being afflicted with disease."

So, what is called the "*Jew's Quarter*," in Rome, is represented by Dr. James Johnson, in his work on change of air, as the dirtiest, filthiest, dampest, "*and the healthiest spot in that famous city*." Being down upon the shores of the Tiber, and more exposed to the vapors from the river, and wet river banks, than any other portion of the Roman Capital, it ought to be sickly, according to the views of the miasmatists, but "it is quite free from the fatal malaria."

And Lisbon, one of the filthiest towns in all Europe, cannot carry on gardening, which, in so dry a country, is of the utmost importance to every family, without artificial irrigation, and that the inhabitants may be able to accomplish this desirable purpose, the water is collected during the rainy season in the cisterns in their gardens, and under their houses.—"The water," says Ferguson, "being of utmost importance, is husbanded carefully, for several months in the dry season. Diminishing daily by drainage and evaporation, it, of course, gets into a most concentrated state of foulness and putridity, with a thick green

vegetable scum upon it; yet no one ever dreamed of its producing fever, although the most ignorant native is well aware, that were he to cross the river, and sleep on the shores of the Alentejo, where a particle of water, at that season, had not been seen for months, and where water, being absorbed into the sand as soon as it fell, was never known to be putrid, he would run the greatest risk of being seized with remittent fever.”* The same author gives us another example of a somewhat similar nature.” “In the West India Sugar Ships,” he observes, “the drainage of the Sugar, mixed with the bilge water of the hold, creates a stench that is absolutely suffocating to those unaccustomed to it, yet it is denied that malaria or malarious diseases are generated even from this combination.”

Drs. John Wilson and Bryson, also bear testimony to the fact, that the foulest and most offensive ships oftentimes prove innocuous; while disease has been known to rage aboard vessels where there was nothing offensive or foul.

So, the water of the Thames, according to Dr. Dunglison, loaded with all the filth and soluble materials, animal and vegetable, which it acquires in its course to the sea, is nevertheless the best water to take on a long voyage; for having undergone a process of fermentation, or self purification, it keeps sweet and potable a great while. Accordingly, merchantmen

* Article on Marsh Poison, &c.

and ships of war fill with it their water tanks, which are situated immediately under the hammocks and berths of the men. Now, during the fermentation of the water, which takes place after a little while, the sleeping apartments, and, indeed, all portions of the ship, are filled with an intolerable stench; yet it never produces disease.

I shall now call your attention to another class of facts. In Guinea, according to Lind, and other writers, during the entire period of continued heat and drought, which sometimes lasts for six or eight months, when everything is parched up, and the earth is literally baked and cracked open in great fissures, and the rivers dried up, or restricted to very narrow channels, leaving a large portion of their alluvial beds and slimy mud banks exposed to the rays of the burning sun, there is no disease. But when the rains have set in, and the parched earth is soaked with water, and the rivers begin to fill up, diseases become rife and the mortality is great.

Egypt, too, which is inundated or partially covered by the overflowing waters of the Nile for nearly three-fourths of the year, and which has its atmosphere filled with the exhalations from stagnant lakes, canals and pools, and the drying up of its deep alluvial soil by the action of a powerful sun, producing an excessive evaporation, enjoys freedom from endemics of intermittent and remittent diseases; and, indeed, since the days of the celebrated Volney, travel-

lers generally have agreed that its climate was salubrious—much more so than Cypress and other parts of the Levant, less abundantly furnished with the supposed sources of miasm. Let us take a single example of this fact. Menouf, the capital of one of the provinces of lower Egypt, although its south and west walls are situated on the banks of a very shallow canal, and near to another still shallower, neither being navigable, and the latter consisting chiefly of stagnant pools, is, notwithstanding, a remarkably healthy place. Besides these canals, there are, in the immediate neighborhood of the town, ponds of dead water, in which the inhabitants rot their flax, with here and there a burying ground, which is overflowed by the high waters from the Nile; but as the waters do not remain on the lands about Menouf as long as they do over most other parts of the Delta, Surgeon Carrie thinks this may be the reason of its extreme healthiness.

So, in our own State, on the lower Roanoke, where the bottom lands are guarded from the river inundations by diking, in August last, owing to a very unusual rise in the river, the levees gave way in many places, and large farms and extensive tracts of land, heretofore protected against such inundations, were overflowed. When this disastrous rise in the river occurred, the farms were covered with luxuriant growing crops, and an abundance of vegetable matter, in a succulent state, occupied the bottom lands and mar-

shes. In many places, all this mass of vegetable matter was destroyed entirely, and left, by the subsidence of the flood, to putrify upon the land, filling the whole air with its stench, whilst the earth's surface, by excessive evaporation, during an unusually warm and long autumn, became perfectly dry and even baked, cracking open in many places with long and deep fissures. Such was particularly the case with regard to the bottom lands and marshes in the counties of Northampton, Halifax and Bertie; and yet, I am informed by gentlemen of high intelligence and standing, part owners of these lands, that, contrary to all expectation, it was an unusually healthy season.

Such a state of dryness, I must admit, perhaps, according to Bancroft, ought not to have evolved miasm; but it is precisely under such a condition of the atmosphere and earth's surface, that diseases are often violent, and the mortality greatest, agreeably to Brown, Pringle, Fordyce, Ferguson and others; and I now propose to examine the subject in that point of view. The last named writer, a standard authority, insists, "that putrefaction and the matter of disease are altogether distinct and independent; that the one travels beyond the other without producing the smallest bad effects; and that, however frequently they may be found in company, they have no necessary connection; and that the cause of disease "cannot emanate from vegetable putrefaction, but is found

most virulent and abundant on the driest surfaces; often, where vegetation never existed nor could exist," &c.*

Dr. Watson, speaking of these views of Ferguson, appears to agree with him in this opinion, for he says: "Facts like these seem to prove that the malaria, and the product of vegetable decomposition, are two distinct things. They are often in company with each other, but they have no necessary connection.—Whoever, in a malarious country, waits for the evidence of putrefaction, will wait, says Dr. Ferguson, too long."

Ferguson also says: "A year of stunted vegetation, through dry seasons and uncommon drought, is infallibly a year of pestilence to the greater part of the West India Islands;" and that "the most ignorant peasant of Lincolnshire knows that there is nothing to be apprehended from the ditches of his farm, till they have been dried up by the summer heat."—Much autumnal disease was likewise observed by him in South Holland, in 1794, after a hot dry summer, at the encampments of the British Forces, at Rosendaal and Oosterhout, where the surface was a level plain of dry sand, without vegetation, and where no vegetation could exist, except the stunted heath plant, and where all the wells of the camps were plentifully supplied with sweet and potable water.

Pringle also bears testimony to the insalubrity

* Article on Marsh Poison, &c.

of the dry, unproductive sandy plains of Dutch Brabant, whilst Fordyce informs us that the British Armies, when encamped upon the pure sandy plains of Flanders in 1810 and 1811, were greatly troubled with intermittents and remittents ; and also, that there is a region in Peru, barren from want of water and vegetation, and yet nearly uninhabitable from the prevalence of virulent fevers. Similar observations have been made by almost every one who has attentively noticed these things. Mr. Charles Darwin, for example, in his voyage of a naturalist, in speaking of the elevated, dry and almost arid coasts of Peru, says: "In all seasons, both inhabitants and foreigners, suffer from severe attacks of ague. The attacks of illness, which arise from miasma, never fail to appear most mysterious—so difficult is it to judge from the aspect of a country, whether or not it is healthy, that if a person had been told to choose within the tropics a situation appearing favorable to health, very probably he would have named this coast."

The result of Ferguson's observations on the medical topography of Spain, is, "that, in the most unhealthy parts of Spain, we may, in vain, towards the close of summer, look for lakes, marshes, ditches, pools, or even vegetation ; and that Spain, generally speaking, though as prolific of endemic fevers as Walcheren, is, beyond all doubt, one of the driest countries in Europe, and it is not till it has again beer

made one of the wettest, by the periodical rains, with its vegetation and aquatic weeds restored, that it can be called healthy, or even habitable, with any degree of safety."

Dr. Brown, a decided miasmatist, confirms this statement, and adds: "He has repeatedly observed that cases of fever and ague abounded in parts of Estremadura, so remote from the Gaudiana or any stream, that no influence from visible water or dampness could be supposed to have a share in their production."*

And Professor Merrill, a man of deserved consideration, in a lecture before the Memphis Medical Society, adverting to the great mass of irrefragible evidence adduced by Ferguson and others against the "decomposition theory;" and in view of the "many well authenticated instances of the prevalence of the most malignant and deadly forms of fever, in the midst of hot and parched up sand plains, where there was nothing to decay, or moisture enough to admit of decomposition even if there were materials for it," says: "Modern writers cannot refuse their testimony against the decomposition theory, unless they are willing to discredit the statements to which I have referred, which no man living has had the hardihood to do, for they are sustained, among other witnesses, by the whole of those vast armies, officers and men, which the British government to the astonishment of

* *Cyclopedia of Practical Medicine.*

the world, kept in the field for a series of years, battling against Napoleon. It is remarkable, that notwithstanding the statements of Ferguson and others, were in direct opposition to a doctrine which had been universally taught and credited for more than a century, no man was found to gainsay the evidence upon which they were founded."

"Some two years ago," continues Dr. Merrill, "I presented before this society, a short account of an epidemic yellow fever, which occurred at the Bay of St. Louis in 1820. Here was also a sandy and barren country, which had been all the spring flooded by excessive rains. These were followed by an unprecedented drought, so that when the disease appeared there were, as in Holland, Spain and Portugal, neither moisture to produce decay, nor substance upon which it could act had it existed. A large number of the most intelligent people in our country had congregated in that place to spend the summer; and no one there doubted, any more than here, that these diseases were caused by the dissolution of organic matter, nor had any one there, perhaps, ever before seen any form of these diseases prevail, where there was none of these materials to decay. It was natural, therefore, that they should be especially vigilant to discover the existence of this necessary cause, with a view to its removal; and I can bear witness that great activity was exercised in this respect. I myself had no more doubt of the truth of the commonly re-

ceived doctrine of causation than I had of the propagation of small pox by contagion. And yet after the most diligent search and enquiry, not a vestige of any organic material was discovered, to afford the least ground of suspicion of injurious influences from this cause."

Bishop Heber, in his account of India, according to Mitchell, says, the wood tracts of Nepaul and Malwa, having neither swamps nor perceptible moisture, in summer and autumn are abandoned, not only by man, but even by the birds and beasts, in consequence of their pestilential character.

In regard to the insalubrity of woodlands, marchetti, before quoted, observes that, "The presence of crowded and extended woods, according to some, and on the contrary, their destruction, according to others, cause malaria. Targioni, on the authority of Doni and others, considered woods injurious, not only for being liable to retain and imprison the principle constituting malaria, but also from being, as he believed, capable of producing them. Such a disparity of opinion proves, in my judgment, that there are circumstances in which a too extensive and general clearing of woods may be equally injurious, as allowing trees and shrubs to increase and multiply without the regulation of man. We find certain districts and houses with a perfectly healthy atmosphere, in the midst of extended woods, while others in similar situations suffer from malaria."

Malta is a barren rocky Island, considerably elevated above the sea, in some places as much as twelve hundred feet. Its substratum consists of calcareous sandstone, scantily covered with soil, most of which has been carried thither. It has no marshes, stagnant pools, swampy grounds, lakes or rivers, yet Major Tullock asserts that it is quite sickly. The same is true of the town of Gibraltar, which is built on a bed of dry red sand, at the foot of the rock of that name, and has no ponds or marshes to furnish decomposing vegetable matter to generate disease. So, too, with one of the Isles de Loss, near Sierra Leone, about a mile in diameter, and at its centre as much as three hundred feet above the level of the sea. It has no marsh, no swamp, very little soil, and only one small piece of arable land, but it is represented by Boyle as one of the most insalubrious spots on the African coast.

Here I might be satisfied to rest the discussion of this question, having already subjected it to the test of the *experimentum crucis*; but I prefer to examine it still further, and under another point of view, lest the miasmatists may think I have not furnished them difficulties enough to solve.

In a great many parts of Kentucky, Tennessee, North Alabama, North Carolina and Virginia, where the country is dry and ridgy, and in many places quite elevated, autumnal fevers occur upon the highest lands, where there is comparatively no moisture,

and where vegetable decomposition, to the extent of poisoning the atmosphere, is never suspected. Professor Wood attributes the prevalence of intermittent and remittent fevers, under such circumstances, to an unaccountable epidemic influence, and not alone, to the presence of marsh poison ; for he says, speaking of the effects of epidemic influences: " Hence, probably, the late prevalence of intermittent and remittent fevers, during the summer and autumn, in portions of the middle and eastern States, in which these diseases were formerly almost unknown ; while the circumstances of these regions, in relation to the production of miasmata, remained, so far as could be discovered, the same as in preceding years." The learned professor does not exactly acknowledge here the agency of two separate and distinct causes for the production of one and the same effect, for he seems to be fully aware how apparently inconsistent this statement is with the previously expressed opinion of the specific febrile character of miasmata in these diseases, and therefore endeavors to reconcile them, by supposing that there is always, and in every place, even in the healthiest situations, where there is no unusual amount of moisture, heat and vegetation, and where intermittent and remittent fevers have been hitherto unknown, a sufficiency of exhalation from decomposing vegetable matter to produce these diseases, if there was only present a little epidemic yeast to enliven the mass. Now, this view of the matter,

in my humble judgment, necessarily leads to one of two conclusions—either to the employment of two causes for one effect, which I have elsewhere stated to be at variance with the order and economy of nature, or amounts to a begging of the question. But let that pass.

Dr. Carpenter, of Louisiana, before quoted, says: "East Feliciana, and the parishes lying east of it, may be taken as examples of this. These parishes consist of high lands, which constitute a portion of the bluff formation of the south, and have an elevation of from one hundred, to two hundred and fifty feet above the level of the Mississippi river at that point. The lands are generally thin and covered with open forests of the long leaf pine, or with those of oak, beech and other trees, intermixed with a growth of the loblolly pine, and other species. This extensive region is traversed by two or three streams of considerable size, which are generally bordered on each side by a narrow stripe of low land. The other streams which are small, run in narrow valleys, and are rarely bordered by swamps or marshes, and when their waters dry up in the summer, they leave their beds generally well washed and clean, or covered by a deposit of sand. In this region, the climate is obviously drier than in the low lands of the delta, as is shown by hygrometrical tables, as well as by the fact, that here the Spanish moss is scarcely met with, while in the low lands it covers every tree, and the growth

of this plant is a good hygrometrical index. Notwithstanding the favorable aspect of these regions, as respects health, the inhabitants are very subject to ague and fever, and that too, is not only the case with those living near the streams, but is equally so with those residing in the highest, most rolling and arid portions."

Dr. Dunglison also informs us that "The bilious remittent is a common disease in every part of Virginia, although more prevalent in the lower than in the upper country. In the latter, it presents itself in localities where we may seek in vain for marshes, or for anything resembling them."

This is likewise true of the whole Maremma district of Italy, which stretches from Leghorn to Terracina, and is a prey to these diseases in every part of it, notwithstanding in many places it is elevated, dry and many miles distant from anything like marshes.

On the other hand, along the south west range of mountains, in Albemarle county, Virginia, a spur of the Blue Ridge, although there are many collections of stagnant water, mill-ponds and meadows, yet intermittents are scarcely ever seen. In this district of country too, the hemp is pretty extensively cultivated, and notwithstanding these ponds and meadows are made use of for the purpose of water-rotting and dew-rotting the plant, it has never been known to produce miasmatic disease.

It is likewise a well known fact that there are

extensive marshes on a portion of the range of Calabrian mountains, which were formerly covered with forest, but which are now cultivated, upon which marshes, thick fogs or mists are always to be found during the night and early hours of the morning; yet the peasants sleep with impunity along the margins of them, and even the proprietors remain in their immediate vicinity during summer and autumn without injury.

Dr. Robert Jackson, in his work on the diseases of the West Indies, informs us, that the same fevers occur in those islands amongst the series of mountain ridges, not exposed to the exhalations from swampy and low grounds, and at an elevation of six or seven hundred feet above the level of the sea; and Dr. Jas. Johnson, in his work on tropical climates, asserts, that these diseases prevail in the high hills and thickly wooded parts of the mountain ridges of the island of Ceylon, and on the secondary mountains and primitive ridges in Sicily; while Dr. Heyne attempts to account for their occurrence amongst the rocky, wooded hills, in the Madras Presidency, distant from any acknowledged source of miasms, by supposing them to be owing to some magnetic influence, dependent upon the ferruginous character of the rocks.

Foucault also mentions, in his work on chronic diseases, that "the mountains surrounding the Agro Romano, at Tivoli, Subiaco, and Terni, are sickly, notwithstanding there are no marshes about them."

And Wortabet says, in his fevers of Syria, "that the town of Hasbeyah, situated on one of the high hills near Mount Hermon, and distant twenty-five miles from the marshy plains of Huleh, is a notorious place for intermittents of the most obstinate character which we have ever seen," while "the villages which are situated between it and the marsh are, on the whole, remarkably healthy."

In the same manner, other distinguished observers have insisted that these diseases have been known to originate and prevail extensively in argillaceous soils, where no vegetable putrefaction was going on, or at all suspected.*

The celebrated Linnæus contended, in his inaugural essay, that periodical fevers originated in all those places where the soil abounds in clay, and only in such places; and Von Aenwank, a Netherlander, endeavors to explain their prevalence in argillaceous soils, by supposing that clay possessed the property of absorbing oxygen from the atmospheric air, and thus impairing its purity.

But Dr. Watson, in his lectures, thinking this matter not so well settled, says: "No very certain or extensive observations have yet been made in regard to the kind of soil from which the miasmata are most apt to be extricated. That which is loose, penetrable, porous and sandy, appears highly favorable to their formation. So are soils which containing much clay are very retentive of moisture."

*Chisholm, Brown and others.

From Dr. Dunglison, we learn that, in the summer and autumn of 1828, the high, ridgy and beautiful shores of Long Island, known as the Narrows, received a fearful visitation from intermittent and remittent fevers, without any assignable cause for it, and when scarcely a single case of either had been known there for forty years previously; nor does it appear, says the Doctor, to have prevailed there since. The same thing has occurred upon the island of Portsea, on which Portsmouth, in England, is situated.—Many years ago, it was believed to be entirely freed from malarious diseases by drainage; but they have recently returned again, not only to the best drained portions of the Island, but even to parts of it which were never before subject to them. So, in our own State, in 1846, 1847 and 1848, districts of country, hitherto exempt from autumnal fevers were terribly scourged by them, notwithstanding there was no apparent difference in the amount of moisture, heat and growth of vegetable matter, from what was usual in such places. The tract of country dividing the waters of Roanoke and Tar Rivers, and extending from the neighborhood of Weldon on the former river, through portions of the counties of Halifax, Warren, Franklin, Granville and Person, having an argillaceous and gravelly soil, with white and red quartz and granitic formation, the purest and finest springs and wells of water, and with a growth chiefly of oak, hickory and dogwood, was, during these years, visited

by autumnal diseases, and in many places through this region, old men, heads of large families, who had never taken a dose of medicine or seen a case of ague and fever, or bilious fever, in their lives, became as familiar with these disorders and their treatment as with household words. Other portions of our State, extending even into the gorges of the mountains, heretofore unfrequented by these maladies, suffered in a like unaccountable manner.

These are some of the facts and circumstances which have induced me to abandon the miasmatic hypothesis; for, whatever this febrile agent may be, if different from the appreciable states of the atmosphere and the earth's surface, it cannot be traced, as I think I have conclusively shown, by the presence of those conditions of moisture, heat and vegetation, which are claimed as indispensable for its production. Nor has any chemical analysis, so far, been able to detect it; nor microscopic investigation, although conducted with all the diligence and zeal incident to a fashionable pursuit, as yet revealed it.

M. Julia, a writer of considerable distinction on marsh miasm, assures us that, after sixty trials to detect the chemical and physical properties of this poison in the air of several very insalubrious marshes, by the most searching analysis, in each instance he found only such constituent principles as are contained in the purest atmospheric air.

Moschati and Broschi also examined analytically

the air of rice fields, and some notoriously unhealthy spots in the papal States, with nearly like results; while "M. Deseye obtained, in the most confined and unhealthy marshes, as on the most exposed hills, seventy-eight parts of Nitrogen, twenty-one of Oxygen, and one of Carbonic acid."

And Dr. Minzi, of the Central Hospital of Terracina, with a view to determine whether, in the genesis of paludal fevers, there was really any special miasmatic principle, collected, by means of an apparatus containing a frigorific mixture, the dew which fell in the vicinity of Rome and Terracina. Of this he and several other persons drank portions varying from ozij to ozvj, without any ill consequences.—Wounds on the legs of two peasants were also washed with the dew water, without any bad effect. He concludes, therefore, that the miasmatic principle, if any such exist, does not reside in the dew of malarious districts, notwithstanding the universal opinion amongst the regular miasmatisist, that the moisture of the air in such situations, when precipitated at night in the form of dew, always carries the miasmata with it, which have been floating in the atmosphere during the day.

Such is the view of this subject which I have thought proper to present for your consideration; and these the facts which the brief space allotted to an address of this kind has permitted me to bring forward in support of my position. Nevertheless, I be-

believe they will, under the operation of the rule which I have laid down for our government in the study of all questions in physical etiology, the scientific value and applicability of which no one can deny, furnish sufficient evidence to convince us that *there is no truth in the doctrine of the miasmatic origin of disease.*

AN ADDRESS
DELIVERED BEFORE THE
MEDICAL SOCIETY OF NORTH CAROLINA,
AT ITS
Fifth Annual Meeting.

*Mr. President and Gentlemen
of the Medical Society of the State :*

It was my purpose to make this communication to you at the last Annual Meeting in Fayetteville, but circumstances of a pressing nature prevented my attending that meeting ; and as I preferred reading to the Society, first of all, my remarks in reply to Dr. Satchwell's strictures upon my address, delivered here three years ago, it will be readily understood why they have not been made public before.

In that address, I emphatically stated that I was submitting for your consideration the chief evidence on which, against the early convictions of education, I was first led to doubt, and finally to reject, a doctrine sanctified by the lapse of ages, and supported by many great authorities in ancient and modern medicine. And being fully aware, that in these times, no proposition in medical philosophy is mooted which does not become a subject of controversy, where every statement is met by a plausible counter asser-

tion, I also stated that, in conducting an inquiry of so great practical importance to the skilful and scientific physician, the mere dicta, unaccompanied by satisfying proof, of the most eminent men in our profession, whose well-established reputation even, would lend interest to any question they might advocate, should not deter me from faithfully investigating truth.

In my zeal, I may have been mistaken in the estimate I formed of the value of these premises ; but as the obligation of candor is imposed on all honest inquirers, having conscientiously formed that estimate, its expression was a matter of course. Since then, however, I have seen no reason to alter my determination. If my argument was not established on the basis of sound reasoning, and supported by the foundations of truth, let it fall. But having written in a true Catholic spirit, if anything therein set forth has served to fix the attention of my brethren, and to fasten investigation upon the subject of the miasmatic origin of disease, I am satisfied that I have discharged a duty to the profession, and am willing to wait its final judgment.

I shall not stop, therefore, to try compliments with Dr. Satchwell, nor to notice whatever of a personal nature may be found in his pages. It is beside the question, and would be in very bad taste.

Nor do I mean to occupy much of your time

with discussing the subject of progress and improvement. But one thing is certain, that from the day when organization first commenced upon the surface of the earth, the law which it has followed has been a law of progress and improvement. Countless thousands of living forms have been produced, and we, the last, are the highest and most perfect. But, even with us, knowledge and power are incessantly advancing, and where intelligence has been given, the law absolutely requires of its possessors to join in the advancing march of mind, or die the death of ignorance and forgetfulness. The poor miserable Indian, standing still, amidst this forward movement, suffers the penalty of this law, and will be blotted from the remembrance of the peoples of the earth, for he dies "unwept, unhonored and unsung."

The law of progress and improvement, then, is the great law of nature, physical and moral. Even in religion, the Jewish Dispensation only made way for the Christian's more enduring faith and brighter hope. And so it cannot be denied but that all those important ideas and great truths which now constitute modern science, were, in their origin, obscurely and imperfectly set forth. Propositions delivered to us by the ancients as true, and seemingly infallible, when viewed under the partial conditions and limitations which circumscribed the field of their observations, become absolutely and palpably false, when transferred to other localities, or are merged in more

general and comprehensive problems. In our philosophy of causes, the extension of our facts enlarges the sphere of our observation and the basis of our principles, thus enabling us to dissolve those errors which arise from a limited and narrower field of operations, by the broad and unerring light of a more general and universal truth.

It was not given to the human mind, when it emerged from mediæval darkness and ignorance, any more than it was given to the human eye, when it comes out of physical darkness into sunshine, to see all objects, even those directly before it, in their proper aspects and true relations. As in the one instance, a period of time must elapse before the eye becomes accustomed to this flood of light, so, in the other, it has required centuries for the human mind to see and understand those wonderful phenomena, in their complicated relationships as causes and effects, which constitute the basis and superstructure of our philosophy.

Upon this question, Dr. Satchwell has taken his own position, with his back to the future, and his face to the past, for the purpose, as he says, of perfuming the memories of the illustrious dead, especially of Lancisi, who teaches, according to him, "that heat, moisture and vegetable decomposition," produce periodical fevers.

Now, Lancisi wrote at the very end of the 17th century, and it was the office of the whole of the 18th

century, and of a portion of the present or 19th, to lay the foundations of physics, or of that group of scientific observations which embrace ultimate elements, and the relationships and reactions of atoms. It could not be expected of Lancisi, therefore, to know much of physics in its most enlarged and comprehensive sense; and accordingly, although I am not much disposed to moot propositions of so remote a character, I intend to show, in the course of my remarks to-day, that such was the fact; and further, that he did not teach "that heat, moisture and vegetable decomposition" produce an effluvium, which is the specific cause of periodical fevers.

What did Lancisi know of Chemistry and Philosophy, as we understand them? Did he know anything of the compound constitution of the atmosphere? And, being ignorant of that, how could he understand the function of respiration, and the true actions of the skin? Did he know anything of Electricity, Galvanism and Magnetism, and of their correlation with heat and light, thus becoming the great motive principles of the universe? Did he understand the proper functions of the brain, great sympathetic, spinal marrow, and the reflex actions of the nerves? Certainly not. And yet Dr. Satchwell says, speaking for himself, of course, and not for us, that being "young in medical observation and experience, we know of no better lights to guide us, than was (were?) given by the illustrious and philosophic Lancisi."

Considering, then, the brilliant discoveries which have illumined the walks of the chemist and histologist, and how much the condition of the natural sciences—especially those pertaining to the philosophy of Life—has been altered and changed since the opening of the last, and during the present century, we ought not, I think, to repose too much confidence in the philosophic opinions of Lancisi. Since his time, the various agents which affect for good or evil our complex organization, have been thoroughly and reciprocally illustrated, by being rendered more definite in character and precise in their relations.—We have been supplied with more new elements, and safer, better methods of investigation, than were known to this celebrated Italian physician, who wrote his treatise *De Noxiis Paludum Effluviis*, in 1695, when, from the necessary imperfection in all chemical and philosophical inquiries, it was impossible for him truthfully to record any other determination upon the subject under discussion, than that swamps and marshes, generally speaking, are more sickly than the high lands. This fact, which I have never denied, Lancisi verified by observation; but strange as it may appear, he nowhere inculcates the abstract idea, that an emanation from decaying vegetable matter, is the specific cause, one and indivisible, of periodical fevers. Indeed, he had very indefinite ideas, both of the nature and effects of this marsh effluvium, for he says: “They are not everywhere and constantly the

same, nor is their constitution always identical; and they cannot all be individually comprehended in one and the same species." "*Non ubique et semper eadem sunt ejusdemque materiæ et singulos sub una eademque specie comprehendere non posse.*" Again: "There are carried into the air various kinds of corpuscles or particles held in solution, and connected rather by accident than by definite laws, which, on being received into our body, produce greater or less disturbance in it, according as they have been variously tempered together, or as they may even approach the nature of a poison." "*Varia quoque in aerem ferri corpuscula, seu particulas solutas, et casu potius quam certa lege societas, quæ, in nostrum corpus ingestæ, minorem vel majorem noxam inferunt prout minus vel minime inter se temperatæ, aut etiam ad veneni prope naturam erectæ sunt.*" But elsewhere he distinctly asserts that there are at least two kinds of poisonous effluvia from marshes, the one inorganic, and the other organic.—The inorganic is "an accumulation of dead and inorganic particles, with impure sulphur, and acrid and volatile salts, with other extraneous matters, which being densely evolved in the exhalations from the waters, affect, in a very unpleasant manner, the sense of smell. The other genus of effluvia is composed of a multitude of worms and ova, which float about in the atmosphere, a distinct host of aerial animalcula." "*Altarum quidam est congeries inorganicarum atque inanimarum particularum impuri sulphuris, salium-*

pue lixivio acrium ac volatiliū, aliorumque exoticorum, quæ, aquis halitibus crasse obvolutæ, ingratum etiam naribus, empyreuma propinant. Alterum vero effluviarum genus constant multitudine vermiculorum atque ovulorum quasi agmen instruuntur in aere."

Here Henry Holland and others might find, in "the illustrious and philosophic Lancisi," an advocate for their theory of the animalcular origin of disease, which Dr. Satchwell, in his essay, disposes of in the most summary manner, without once supposing, I am sure, that his ancient friend held such dogmas. Yet, Lancisi, doubtless for the purpose of fortifying his doctrine as to the insect origin of disease, refers, with evident satisfaction, to the opinions of Vatro, Columello and Vitruvius, and speaks of a host of animalcules, not appreciable by the eye—"quæ non possunt oculi consequi"—but which are capable of insinuating themselves into our bodies, through the mouth and nostrils, and of producing serious diseases—"difficiles morbos;" and he, also, speaks of the noxious influence of "the winds and flatulent discharges and exhalations thrown off by these insects." "*Sed in flatibus collocat exhalationibus ab iisdem insectis potissimus emissis.*"

In regard to the morbid effects of these effluvia, Lancisi inclines to the belief, that the inorganic portion can scarcely be considered of itself, a cause of disease, whilst the organic or animalcular portion affects our bodies chiefly in a three-fold manne :

" 1st By mere irritation, and by the wounds they inflict.

2nd. What is more serious, by mingling their corrupt juices with the fluids of our own bodies.

3rd. Lastly, by affording nourishment to the parasitic intestinal worms."

"Primo; Per se ipsa irritando, vulnerando que.

Secundo; Quod forte deterius est pravorum suorum succos cum nostris liquidis permiscendo.

Tertio; Denique indigenas lumbricos nutriendo saginandoque."

So much for Lancisi's ideas of the nature and mode of action of the marsh effluvia, which, differing very much in their chemical and physical character, produce, he says, a diversity of diseases besides periodical fevers. These latter disorders are not always brought on, he thinks, by miasmas, but may be induced by "checking the perspiration, by which the noxious and useless matters, which otherwise accumulate in the system, ought to be carried off from the body." "*Unde fit, ut quæ nostris e corporibus persperari deberent vel noxia, vel saltem inutilia corpuscula magnum partem prohibenter effluere.*" And further, "that a wind from any quarter, however salubrious it may be, is adequate to produce this malady (intermittent fever) by the force of its current alone."—*Quamobrem quilibet ventus, tametsi saluberrimus, malum istud sola impulsione vi producere valet."*

Thus, whatever importance Lancisi may have

attached to the morbid influence of marsh miasms, and however heterogeneous in their *essential constitution* he may have considered them, he evidently did not believe that periodical fevers could not arise from other causes than this contamination; for he distinctly states that a check of perspiration, which prevents the escape of the peccant humors from the system, will induce these diseases; and that the purest breezes, *tametsi saluberrimus*, no matter from what quarter they may blow, are adequate to produce them.

However, I shall now take leave of Dr. Satchwell's notions about progress and improvement, after commending him to a careful husbandry of his strength and resources, as the race *before him* leads a long way backwards, satisfied the while, although by virtue of his learning and zeal he may be able to make considerable progress, that the universal opinion will be his movement is retrograde, and not onward with that advanced corps of scientific investigators, who are marching forward with increasing and expanding intelligence. *Nullum vestigium retrorsum.*

But let us proceed to the discussion of our subject, which I propose to do, by noticing the facts and arguments of Dr. Satchwell, under the three following heads, to wit:

First. He has failed to show that the periodical diseases which prevail in high, ridgy and mountainous districts, and other situations free from swamps

and marshes, are owing to an emanation from decomposing vegetable matter.

Secondly. He has utterly failed to prove the sanitary properties of salt mixing with fresh water, under circumstances that would certainly produce miasmatic diseases, were the salt water absent.

Thirdly. His statements are incorrect with regard to the Roanoke country, and some of the swamp lands of our State.

Under these three heads may be comprised all the main features of Dr. Satchwell's address that are pertinent to this inquiry.

Dr. Satchwell endeavors to account for the miasmatic origin of fevers in elevated situations, and other places free from swamps and marshes, by quotations from the works of Drs. Wood, James Johnson, Irvine and Holmes. Now, for the purpose of arriving at the true value and real importance of their opinions in the premises, I shall endeavor to ascertain, in the first place, whether they carry with them satisfying proof of the truth of the doctrine, or are only pure hypotheses—mere conjectures—unsupported by such facts and conditions as should constitute the proper basis of every philosophical inquiry. And, in the second place, try and find out by cross-examining these witnesses, who have been brought forward so imposingly to enlighten our minds, and fortify our judgments upon this vexed question, whether even they

believe in the truth and sufficiency of their own views as therein set forth.

First, then, of Dr. Wood, the learned Professor of the University of Pennsylvania, who says: "It is well known that most soils, even when to the eye they show no trace of vegetable matter, yet abound in seeds of various plants, often even at great depths; and peculiar circumstances may lead to their decomposition, and the consequent exhalation of volatile products, though no such result may be obvious."

Now such products must be hydrogenated, carburetted, and ammoniacal gases; yet it has never been shown in all the extensive and diligent researches which have been instituted upon the subject, that either one of these gases singly, or any combination of them even, has been the cause of fever. On the contrary, it has been satisfactorily proven that persons exposed to these gases, in large manufacturing establishments, are generally more healthy, or certainly no more liable to intermittents and remittents, than those who have not been under the influence of such exhalations.

But why did not Dr. Wood state, what I undertake to assert, no one will deny, and what he elsewhere teaches, namely: that all natural soils abound in vegetable matters, though not evident to the eye, and then inform us what "peculiar circumstances"—for, being "peculiar," they must be different from the

common ones, heat and moisture—"may produce their decomposition." In so doing, he would have made a real and substantial contribution to medical etiology, and rendered a great and acceptable service to suffering humanity. Then we should know when and where to expect these miasmatic diseases, provided it is only necessary to have an emanation from decomposing vegetable matter to produce them; whilst in our present state of ignorance upon this subject, it is by sad and lamentable experience alone we are taught that many apparently delightful regions of country, where there are no marshes or swamps, with their smiling table lands and verdant fields, so capable, under the hand of industry, of ministering to man's wants and comforts, are, nevertheless, occupied by an invisible enemy, whose baneful influence renders all these advantages worthless.

Moreover, how does Dr. Wood know of the "exhalation of volatile products, though no such result may be obvious," consequent upon vegetable decomposition, brought about by other circumstances than heat and moisture? And more than all, how does he know that these "volatile products" are capable of producing disease? Certainly, such an opinion is directly at variance with the following extract from the same work, which was quoted by Dr. Satchwell: "The circumstances," says Dr. Wood, "which appear to be essential to the production of miasmata are heat, moisture and vegetable decomposition."—

What, then, becomes of the "peculiar circumstances" which Dr. Satchwell so earnestly insists afford us a satisfactory solution of the difficulty in hand? Why clearly, in the estimation of Dr. Wood himself, the "*peculiar circumstances*" become non-essentials—entirely worthless—so far as the production of miasmata is concerned; while the "volatile products," which result from their action on vegetable matter, *a fortiori*, not being miasmata, are without value in this inquiry.

In another part of this work, dissatisfied, evidently, with the above explanation, Dr. Wood attributes the occurrence of miasmatic fevers in situations generally healthy, or where they have been hitherto unknown, to the action of an epidemic poison on the miasms, a sufficiency of which exhales from every soil, and in every situation, to produce disease, when aided in this manner. Thus speaking of epidemic influence, he says: "Hence, probably, the late prevalence of intermittent and remittent fevers, during the summer and autumn, in portions of the Middle and Eastern States, in which these diseases were formerly almost unknown; while the circumstances of these regions, in relation to the production of miasmata remained, so far as could be discovered, the same as in preceding years."

Again, when treating of irritative fevers, he says: "In some instances, the disease appears to assume the intermittent form. At least I do not know how oth-

erwise to account for those cases of intermittent fever, which we sometimes meet with in situations beyond any suspicion of miasmata, and in individuals who, so far as can be ascertained, have never been exposed to their influence."

Thus Dr. Wood furnishes us with three distinct modes of accounting for the occasional prevalence of periodical fevers, in situations generally healthy, and where there are no unusual states of heat, moisture and vegetable decomposition, which latter conditions, he declares, are essential to the production of miasmata; yet Dr. Satchwell brings him forward as a competent witness to prove that a specific poison, one and indivisible, emanating from vegetable decomposition, produces these diseases.

Let us now examine Dr. James Johnson's solution of our difficulty, and through him, Irvine's explanation of the same subject. Johnson says: "Water, imbued with animal and vegetable matters, may sink into the soil, and either remain there, or percolate under the surface till it finds an issue in a spring or river. This is known to be the case in numerous instances, and in almost every country." He further declares, that pestiferous emanations may exhale from it through the cracks in the surface of the earth, during the hot dry months of summer and autumn.— "Thus (says Irvine) some places in Sicily, though on very high ground, are sickly; as Ibesso or Gesso, about eight miles from Messina, situated upon some

secondary mountains lying on the side of the Primitive Ridge which runs northward toward the Faro.— It stands very high, but still there is some higher ground at some miles distance. Water is scarce here, and there is nothing like a marsh.” Here we have another extraordinary conjecture, quite different from those given by Prof. Wood, although none the less hypothetical, to account for the generation of marsh poison in the highlands and mountains, where “water is scarce, and there is nothing like a marsh.” This, however, was necessary, since it was ascertained by observation, that the highlands of Sicily, remote from every thing like swamps and marshes, were as sickly as the lowlands.* The human mind, therefore, fruitful in expedients, but in this instance, determined to adhere to the old theory, that an exhalation from decomposing vegetable matter, is the specific cause of periodical fevers, set to work to frame an explanation that would square with this doctrine. Unfortunately for its friends, however, it carries the stamp of absurdity upon its very face, besides being directly at variance with the opinion of Dr. Johnson, in his work on Tropical climates, where he says: “Experience and observation have proved that these febrific exhalations arise from the *summits of mountains*, as well as from the surface of swamps. The mountains of Ceylon, covered with woods and jungles, and the vast ghauts themselves, give origin to miasmata that

*Smith.

occasion precisely the same fevers as are witnessed on the marshy plains of Bengal."

Thus there is no "higher ground at some miles distance," in Ceylon, to send down a supply of water to furnish "these febrific exhalations," for they "arise," says Dr. Johnson, "*from the summits of mountains as well as from the surface of swamps.*"

But how can any one believe for a moment, who reflects seriously upon this subject, that the rain, which falls upon the mountain tops, where there are no marshes, swamps or stagnant pools, in percolating through the soil to find its way to the ocean, thus forming the veins of water in the earth, which supply us with our purest and most wholesome springs and wells of water, should, nevertheless, throughout its course under the surface, carry with it so much impurity from decomposed vegetable matter, as to furnish the specific effluvium, marsh poison, through every crack, and crevice, and piece of plowed land that it passes under? Can any one believe it? No; not even Dr. Johnson himself. Accordingly, in the same work, "Change of Air," from which these extracts were taken, but in a different part of it, he emphatically so declares. Speaking of Pellagra, he says: "The cause of this frightful epidemic has engaged the pens of many learned Doctors. But it is just as inscrutable as the causes of hepatitis on the coast of Coromandel—Elephantiasis in Malabar—Beriberi in Ceylon—

Barbadoes-leg in the Antilles—Goitre among the Alps—the Plica in Poland—Cretinism in the Val-lais, or *Malaria in the Campagna di Roma*.”

Furthermore, in his work on Tropical Climates, when speaking of Irvine’s statements about the Fiumares in Sicily, he quotes that writer more at length, and to the effect of entirely destroying the application which is made of his remarks, in his work on Change of Air, where the following, which is only a continuation of that quotation from Irvine, is entirely omitted: “At this station, however, (that is, Ibesso, or Gesso,) sickness seldom occurs, unless after rains falling when the ground is yet hot, which is during the heat of summer, or early in autumn, *when all circumstances combine for the production of Miasmata*. I remember, says Irvine, a muleteer passing over the hills near Ibesso, in the middle of August, during a heavy rain, who remarked that *these rains, falling on the heated ground*, would cause a stink, and that many would be poisoned.”

Thus another important witness not only contradicts himself and fails to support the cause he is called to sustain, but, in my humble judgment, makes against it by declaring the cause of malaria to be inscrutable, unknown, whereas Dr. Satchwell contends that it is an emanation from decomposing vegetable matter.

I will now call your attention to what is said of Fort Macomb, in Middle Florida. Dr. Satchwell

says that, "in general terms there was no decaying vegetable matter about the place,"—that ephemeral fungi, of an unhealthy kind, and most disgusting and nauseous odor, flourished in great abundance about the fort—that the moisture to produce these fungi was obtained from a stratum of putty-like clay, underlying the surface and extending under the fort. "Here," says Dr. Satchwell, "was the source of the moisture, and here was presented a combination of those causes requisite to the generation of that form of malaria, which was necessary for the production of the disease which prevailed at the fort."

That this locality was a very damp one cannot be denied. Indeed, from the profuse growth of mushrooms, which are known to require a great deal of moisture for their support, and from other facts which I shall adduce from Dr. Holmes' own statement, I intend to show that this place, although situated on a comparatively elevated tongue of sandy land, underlaid with mud and clay, between the Suwannee River, on the one hand, and a small stream entering into it on the other, was, obviously, an excessively damp one, and therefore unsuited for a fort or dwelling. It is like many places along the banks of our sluggish streams, and in the midst of some of our extensive swamps, where we often find knolls of sand, underlaid at varying depths of from one to several feet, by strata of mud or stiff clay, while the surface, especially about the roots of the trees, is covered with

a short green moss, or a few mushrooms, with the bodies and branches of all the trees, pines and oaks, constantly wet, and literally festooned with the long spanish moss, *Tillandsia usneoides*.

It is to be regretted, however, that Dr. Satchwell did not inform us what that combination of causes was, which produced the particular form of malaria experienced at this fort. Was it other than the combined action of heat, moisture, and vegetable decomposition? If so, what was it? The miasmaticists, it will be remembered, contend that all three of these elements are absolutely necessary for the production of febrific miasmata; and yet, in this particular instance, at least, it is admitted that "in general terms there was no decaying vegetable matter about the place," for Dr. Satchwell durst not infer the existence of miasmata from the offensive putrefaction of mushrooms, since he clearly maintains, when speaking of the Roanoke country, that the offensive decay of vegetable matter does not produce disease. It is equally to be regretted, that he did not tell us what particular form of malaria was present at this locality. Was it different from that form which produces ague and fever, bilious fever, and yellow fever? If so, what constituted the difference? Was it owing to the fact that "in general terms there was no decaying vegetable matter about the place," and therefore no exhalation from vegetable decomposition could enter into its character and nature? Or, after all, does

Dr. Satchwell believe in different forms of malaria as "necessary" for the production of the different forms of periodical fevers; and that, at least, one of the most deadly of these forms may be produced in a situation where "there was no decaying vegetable matter about the place." If he does, then he virtually surrenders the question, and the abstract idea of a specific poison, one and indivisible, which exhales from decomposing vegetable matter, and produces periodical diseases, becomes a mere figment of the brain.

Now, the truth of the whole matter is simply this: Fort Macomb is an excessively damp place, and ill-suited, therefore, to the purposes of a fort or dwelling. Dr. Holmes says: "This locality being the principal one in the neighborhood, covered a space of about two hundred square yards." It had a stratum of stiff white clay underlying most of it "at varying depths of from one to several feet," and that you might trace it (the clay) with almost unerring "certainty by the nature of the dead and living vegetables on the sand above it." "Heavy branches and trunks of pines and oaks, would be moist and wet in the dry months of winter, in Florida, while a profuse growth of ephemeral mushrooms, such as spring up in the North only after heavy rains, would meet the eye at every step, even when rain had not fallen for several weeks..... dotting with their pure vermillion color nearly every inch of ground in the locality." This description answers very well for many

places in the unhealthy portions of North Carolina, and will no doubt be recognized for an old and familiar acquaintance, excepting the mushrooms, by some of the medical gentlemen present.

This same writer, Dr. Holmes, whom Dr. Satchell accounts very learned and very reliable, says: "The want of rain, and consequently of moisture in the earth, will forever relieve the Mexicans from the curse of malarial diseases."

How widely different is the experience of Dr Porter, who, as surgeon of the army, accompanied the regular troops, from Corpus Christi, along the line of operations on the Rio Grande to Sattillo, and afterwards from Vera Cruz to the city of Mexico. He informs us, in his "Medical and Surgical notes of the Campaigns in the war with Mexico," that "the men were hale and hearty after the severe winter at Corpus Christi; for the invalid and worthless portion of the troops had been left behind:" but that intermittents and remittents were rife in and about Monterey before and after the capitulation of that place, notwithstanding it has "an elevation of more than 4000 feet above the level of the sea."

"The inhabitants of the town," he says: "have suffered severely from fevers, as well as our troops; from the hospital at the Casa Arista to the Plaza de la Capella, Campo Santo, or 'Cemetery,' a distance of half a mile, whole families have been sick with intermittents and remittents."

He further says: "In the city of Mexico, elevated, according to Humbolt, 7,469 feet above the level of the sea, all the causes of disease which were in action at Monterey, operated in a still greater degree, and the wounded, it is well known, recovered badly."

"These causes of disease, variable temperature of the day and night in autumn, *the development of malaria*, the fatigue and exposure of the troops, imperfect hæmotosis, and the suppression or rapid evaporation of the perspiration, appear sufficient to account for the mortality among our troops in the valley of Mexico, from wounds, fever, and dysentery."

And so, Dr. Black, a very clever writer on the causes of malaria, in the New York Journal of Medicine, after residing for some time in California, informs us that nine-tenths of the diseases in that sickly country "are unequivocally of malarious origin," notwithstanding the fact that, "from April to November there is a complete deprivation of appreciable moisture—no rain, no dew, or fogs."

Such are the authorities and statements brought forward to prove the miasmatic origin of periodical fevers on the hills and mountain ridges, and other places spoken of in my address, where "water is scarce, and there is nothing like a marsh," and which Dr. Satchwell sanctions and approves of in the following language: "Many situations in our own State and country that are counterparts to such places as have

been thus described, and where malarious fevers prevail, are often brought forward as stumbling blocks against the old malarious theory of Lancisi, but, as it appears, on insufficient grounds."

But, notwithstanding Dr. Satchwell's endorsement of these different and contradictory methods of solving this difficulty, he surely does not believe in their entire truth; for, in accounting for the prevalence of these fevers, during the years 1846, '47, '48, in the hilly, mountainous, and hitherto salubrious portions of North Carolina, he endeavors to prove their miasmatic origin in a manner the reverse of all this. Then, it suits him to have an overland, instead of an underground theory, and to declare that the malaria which is sometimes found on high and dry ridges has been attracted to them, and falls in the night time, after its dispersion in the air during the day; or is carried thither by the winds. "In this way," he says, "malarious fevers occur on ridges and hills frequently; but it is equally true, that such high places and hills as have not wet ground at their base are remarkably salubrious."

Thus, Dr. Satchwell himself furnishes us separate, distinct and contradictory modes of accounting for the origin, from marsh poison, of those periodical fevers which prevail where "water is scarce, and there is nothing like a marsh;" whilst his attempted explanation with regard to the pregnant example furnished by the exploring expedition, as referred to in my ad-

dress, of the unsoundness of the miasmatic theory, is worse than useless. It does not meet the case at all. It was only that portion of the expedition, which was detailed for land service, after reaching Oregon, that was sickly at the encampment on the Wallamette. The remaining portion, which had been equally as much exposed in the travels and duties amongst the Friendly, Society, Feejee, Samoan, and Sandwich Islands, escaped the disease entirely. It could not, therefore, be owing to the exposure to miasmata in these islands, which rendered the encampment on the Wallamette a sickly one.

Dr. Satchwell is equally unfortunate, I think, in impressing his readers with the belief, that the prevalence of periodical fevers "throughout Raleigh and vicinity," in the years 1846, '47, and '48, was owing to the emanation from mill-ponds in the neighborhood. The mill-ponds which, "according to the opinions of the Raleigh Physicians, of that day," produced the fevers in 1822, '27, and '28, had been destroyed for more than twenty years, and none others had been erected; yet Raleigh, and the whole surrounding country, including places where the disease had hitherto never made its appearance, was more sickly than at any former period, even in the days of the mill-ponds.

But I shall now leave these learned doctors to settle their own differences—*non nostrum tantas componere lites*—and proceed to the consideration of the second division of my subject, wherein I propose to

show that Dr. Satchwell entirely fails to establish the sanitary properties of salt mixing with fresh water.

Upon this question Dr. Satchwell says: "We incline to the opinions of Dr. Robert Jackson; Dr. Dickson, of Charleston; Dr. James Johnson, an English author of great observation; Dr. Drake, the Nestor of the profession in the West, and many other medical luminaries in the old and new world, that it *does* possess sanitary properties." With equal propriety, and more show and force of reason, he might have yielded his assent to the opinions and views of Professor Wood, of the University of Pennsylvania; Professor Dunglison, of the Jefferson Medical College; Dr. Eberle, one of the early medical writers of this country; Sir John Pringle, "an English author of great observation" and experience; Dr. Joseph Brown, the celebrated author of the very popular article, "Malaria," in the Cyclopedia of Practical Medicine, who says, "marshes, whether salt or fresh, are prolific sources of malaria;" Monfalcon, who gives a number of instances to prove the insalubrity of a mixture of salt and fresh water, of which the following are interesting examples: In the South of France there are two pools, Valdec and Engrenier, very near each other, being separated only a few rods. The former is very salt, while the latter is quite fresh. But whenever these pools rise and run together, as they do sometimes, the adjoining localities immediately become very sickly, which is not the case at other times.

And also, that there is, to the South of the Ligurian Appenines, near Lukes, a very large marshy plain, accessible to the high tides of the ocean, which rendered the neighboring country almost uninhabitable, until the salt water of the sea was shut off from the fresh water of the marsh, when, as in the case of Viareggio, it became very healthy, and the population increased rapidly. Fodere, treating of this subject, affirms that the vicinity of large lakes, rivers, or the sea, is ordinarily healthy, "unless there is an admixture of salt and fresh water;" and such too, is the opinion of Fourcault, Marchetti, and a host of "other medical luminaries in the new and old world." Even Lancisi assures us that "the air is dreadful in low places, near the sea-shore, into which the waves find entrance by a canal that has either been open during the memory of man, or made by human contrivance, or produced by a storm; and into which receptacle also, the rains wash down the filth from the adjacent hills and knolls."

Indeed there is not a shadow of doubt, but that numbers, and the weight of authority, would decide that salt mixing with fresh water *does not* possess sanitary properties. But this is not the proper method, of settling any important question. Try it rather by the rules of just argument, and common sense—by the *instantia crucis*, if you will—and see where the truth lies. Accordingly, I shall subject it to this criterion; but before doing so, I will make

the subjoined extract from Dr. James Johnson's work on Tropical Climates, for the purpose of showing how little weight his authority should have in this matter. Speaking of bilious fever, which Dr. Satchwell, I dare say, believes is owing to marsh poison, and therefore cannot occur under the sanitary influence of salt water, Dr. Johnson says: "This is the grand endemic or rather epidemic (*morbus regionalis*) of hot climates, and although greatly allied in many of its symptoms, perhaps generally combined with the marsh remittent already described, yet it occurs in various places, both at sea and on shore, where paludal effluvia cannot be suspected." Now, this, extract, under any point of view, contains much that should be highly interesting to the miasmatists, and I therefore take great pleasure in commending it to their especial consideration, notwithstanding I have brought it forward in this particular connection, to show that bilious fever may occur at sea, "where paludal effluvia cannot be suspected," and despite the supposed sanitary influence of salt water.

But let us proceed with our instances, and inquire why it is that Galveston Island, a mere bed of drifted sand, scarcely elevated above the Gulf, and subject to inundations from its waves during the prevalence of Southern and Eastern winds, should be so much more sickly than the Island of Grand Terre, situated at the mouth of Bayou La Fourche, with a productive soil, and elevated several feet above the

highest tides of the Gulf? Or why the head of Pensacola Bay, where the Escambia River empties, and where they have sea breezes and brackish waters; or the shores at the mouth of Mobile River, and around Mobile Bay, where the waters are quite salt, should be more sickly than the Balize? The Island of Key West, which is a portion of the Florida Reef, with a slight soil, supporting a scanty growth of herbaceous vegetation, small trees, and shrubs, had, several years ago, ditches and small canals cut through it by Commander McIntosh, to allow the tides of the Gulf to flow into the marshes, and the fresh water of the great rains to flow out of them; yet this situation is much more sickly than the rice lands of Louisiana, which are not overflowed by the Gulf waves, but which Dr. Randall states are not unhealthy, though cultivated by white men. And so I might inquire why the Mississippi and Amazonic Deltas are so much more healthy than those of the Niger and Ganges? Or those of the Scheldt and Rhine, and Po, so much more sickly than the Nilous Delta? Or how it is, that British Guiana has been rendered, by the diking out of the salt waters, "capable of being healthfully tenanted by European residents," notwithstanding "its wide alluvial tracts."

Thus I might go on multiplying authorities and instances to prove that salt mixing with fresh water *does not* "possess sanitary properties;" but I prefer to give this question, so far as Dr. Satchwell is con-

cerned, the *coup de grace*, by showing that the main facts which he relied upon to establish his position, have, in the regular course of events, been turned against him, demonstrating with what imprudent haste he has jumped to unwarranted conclusions. It was this "loose and too hasty system of generalization, attempting to define the complex before the simple is faithfully learned," which I have elsewhere stated, "has led medical minds, loaded with hypotheses, into endless vagaries and absurdities in their speculations upon the subjects of practical etiology."

"Some four or five years ago," says Dr. Satchwell, "a new inlet broke in from the ocean into Pamlico Sound during a severe storm. Since then the waters of the Pamlico and its tributaries have been much more salt than ever before; and since then the whole Pamlico region, where salt water extends, has been more than ordinarily exempt from malarious fevers?" "It has been unusually healthy in the Pamlico region, where there is salt water, since this new formation of nature." "Places in the vicinity, and on the sound, and river, and branches, have been unusually free from fall sickness within this period, that were sickly before, and under those circumstances of season, too, that formerly attended sickness."

The essay, from which the above extracts were taken, was delivered in the early part of May, 1852, after several years of unwonted health in all the East-

ern or paludal portions of North Carolina, and after the opening, some years before, of a new inlet into Pamlico Sound, which rendered the inland waters, for a considerable distance from the ocean, quite saltish.

So far, so good. Here is a concurrence of events, and if the healthiness of these portions of North Carolina had certainly and immediately followed upon the opening of this new inlet, as stated by Dr. Satchwell, and remained so, and that too, after the same district of country had been as certainly rendered insalubrious by the closing of the old inlets, then we should have had something like what a cause and its effects should be to challenge our admiration and respect. But, in reality, how does the matter stand?—Did the unusual amount of health enjoyed by these sections of our State, immediately and certainly follow upon the bursting open of this inlet? It certainly did not; but rather preceded it. This cycle of comparatively healthy years began before the inlet was opened, and terminated whilst it was still as open as it had ever been, thus showing that there was no connection of cause and effect in this instance, but only a coincidence. This cycle of healthy years began in 1845, a year or two before the inlet was opened, and terminated with the summer and autumn of 1851, just prior to the delivery of Dr. Satchwell's essay on malaria. But he did not know this fact. How could he know it? The sickly season of the year 1852,

had not yet come on; and, of course, the inlet being still open, and the waters brackish, he would not suspect it. Had he postponed the publication of his views until the autumn following, when the whole of the Pamlico country was remarkably sickly, notwithstanding this new inlet was more open, and the inland waters more brackish than for years before, he would have had an excellent opportunity to review his opinions upon this subject, a little matter of trouble which no real philosopher ever shrinks from, but rejoices at, as it justly affords him the occasion of another effort to investigate truth, after having satisfactorily demonstrated a false fact. The truth is, the years 1852 and 1853, were very sickly years, even for that sickly country, notwithstanding this new inlet was as open as ever, and the inland waters more brackish than before.

In Edenton Bay, and in the mouth of Chowan River, at the head of Albemarle Sound, the waters were quite brackish, and crabs and salt-water fish, which had not been known there before for twenty years or more, became quite plenty. And at Hertford, on the Perquimons River, a steam mill found it impossible to use, with convenience and advantage, the river water, which had always been done before, on account of the incrustations of salt in the boilers; yet these situations, and all the adjoining country, on both sides of the sound, and on its tributaries, were more sickly than they had been known to be for a

great many years. Even in the Fairfield and Mattamuskeet country, where, according to Dr. Satchwell, "the farmers have made model farms in as rich and fine a country as the sun of heaven ever shone upon," periodic fevers have prevailed for the last two years, notwithstanding, in his judgment, "drainage and long cultivation have removed that *moisture and vegetable decomposition essential to the generation and extrication of malaria*" from the soil.

But instances of healthy and unhealthy years or seasons, in paludal districts of country, recurring even at somewhat regular or stated periods of time, have frequently been observed and spoken of by different writers on periodic fevers; while the circumstances of those regions, so far as relates to the production of miasmata, by the decomposition of vegetable matter by heat and moisture, remained the same. Such facts are not only remarkable, but they cannot be explained by the popular doctrine of a specific miasm, which emanates from the decomposition of vegetable matter.

I come now to the third division of my subject, in which I mean to show that Dr. Satchwell's statements are incorrect with regard to the Roanoke country, and some of the swamp lands of our State.

He thinks my difficulty natural enough with one "unacquainted with the true condition of that region" in 1850. Now it so happens that I am not only very well acquainted with that region of country general-

ly, having practiced through it, on both sides of the river, for several years, but that I informed myself thoroughly with regard to its circumstances and condition before and after the great fresh of 1850, previous to writing a word upon the subject, in my address of 1851. Dr. Satchwell is mistaken in supposing the spring and early summer of 1850, upon the Roanoke, were unusually dry. They were unusually wet; and this statement is confirmed, not only by the recollection of the planters on the river, but it is established, made a fixed fact, beyond all doubt or contradiction, by the farming journal of Mr. John Devereux, an intelligent gentleman and planter on the lower Roanoke, who keeps a daily record of the weather, seasons, and work done upon his plantation.

From this source, the most reliable of all others, I am furnished with the indisputable proof, that the spring and early summer of 1850 were wet seasons; and that the drought, which became intense during the months of July and August, did not set in until the latter part of June. Mr. Devereux was not able to get all his land in order for the planting of corn until after the first week in June, on account of the rains and incessant wet. Others were similarly situated; and these facts, recorded four years ago, on the days of their occurrence, by Mr. Devereux, who lives in the immediate neighborhood of other large planters, whose statements are corroborated by his jour-

nal, show that the very circumstances, viz: a wet spring and early summer, succeeded by a drought, which the miasmatists claim as best calculated to produce febrile exhalations, existed in this instance, and yet there was comparative exemption from disease.

Moreover, Mr. Devereux lives in the neighborhood of the most extensive region of flats and bottoms that are to be found upon the Roanoke. They are known as the marshes, *par excellence*; and it is further known, that some of these did not dry up entirely until August—if then.

Dr. Satchwell is also mistaken in asserting that, after the embankments on the river gave way, in the latter part of August of that year, the flood of “waters rushed with irresistible rapidity to the ocean, remaining but a few days on the low grounds.” So far from this being the case, the bottom lands and swamps remained covered with water for a considerable time; and some of the ponds, which had been filled with water at the flood, being incapable of emptying themselves regularly and “*rapidly*” along with the receding waters of the river, retained most of it, and exhibited its visible effects until the last of November, or until the rains of winter set in. Indeed, just such a state of things existed in this instance, with regard to the filling up of the swamps, and bottoms, and ponds with the overflowing waters of the river, as is described by Dr. Satchwell, from Dr. Jas. Johnson’s work

on Tropical Climates, for the Ganges. "Overflowing," he says, "the banks as it does, and filling the pools and bottoms at some distance back, the water stagnates. The vegetable matter is thus acted on for weeks, under the most favorable decomposing circumstances."

But the overflowing of the banks of rivers, lakes or other collections of fresh or salt water, during hot weather, particularly after the receding waters have fallen within their natural limits, or bounds, has always, and everywhere, from the days of Lancisi to the present time, been considered by the miasmatisists to be a fruitful source of febrile exhalations. Thus Copland, in his Dictionary of Practical Medicine, article Endemic Influences, says: "Inundations, whether from the sea or the swelling of rivers, or from an admixture of sea with river water, render low grounds particularly insalubrious upon their being exposed to the action of the sun's rays."

As to the sickness which occurred on Mr. James C. Johnston's plantation on the Roanoke, it may be remarked that the simple circumstance of his letting the water into his mill pond from the river, and the subsequent exhaustion of it during the early part of November, could not be the cause of disease. This pond gets empty nearly every year during the latter part of summer, and under the drying process, according to the best accredited views of the miasmatisists, furnishes an abundance of material for febrile

exhalations, because the muddy bottom and "vegetable matter is thus acted on for weeks, under the most favorable decomposing circumstances;" yet it has never been the cause of disease on this plantation, nor does Mr. Johnston, than whom there is no more capable judge, believe it was the cause of sickness this year. He says the plantation every year, from the circumstance of the swamps and ponds drying up in the summer, affords more sources for emanations from decomposing vegetable matter, than it did this year, yet it is one of the healthiest plantations on the river.

Besides, the sickness which prevailed at this place was typhoid fever, which commenced in the very last of October, or early in November, and extended through the *winter*, becoming typhoid pneumonia, as is usually the case with that disease, whenever it assails a plantation of negroes on the Roanoke, late in autumn, when bilious fevers generally have ceased to manifest themselves, and runs into the winter months. These facts are abundantly proven, not only by my own experience, but by the experience of every medical gentleman "*familiar*" with these localities, and with the typhoid fevers, which sometimes assail, in a most unaccountable manner, the negro population on some one or two of the large plantations on the Roanoke, while other places, apparently no better, if so well protected against zymotic influences, escape entirely.

Whilst upon the subject of the Roanoke bottoms, I will mention the fact that many of these swamps have been extensively worked by timber and shingle getters. The timber is mostly cypress, not juniper, and has been gotten up into shingles, or logs, in which latter shape it is floated to the saw mills to be cut into lumber. By these means the swamps have been greatly thinned of their heavy growth, and that foliage which protected the soil from the sun's rays.—Many of these timber swamps are connected with the adjoining plantations, being owned by persons who farm upon the higher grounds and reclaimed bottoms, while they work up the timber of the swamps and marshes. I have practised among these plantations, but my patients were furnished from the farms, and not from the swamps, notwithstanding the swamp hands were in the habit of coming out of the swamps on Saturday evening, and remaining at the quarters of the plantation negroes with their wives and families until Monday morning; and notwithstanding, further, the swamps are sufficiently cleared up, in many instances, and dry enough too, in the latter part of summer, and in autumn, during the bilious fever season, to have cart ways through them, even to the bank of the river. What I have here stated with regard to the Roanoke Swamps and bottoms, is not only strictly true of them, as may be established by a mass of irrefragable testimony, but it is likewise true of many other portions of the swampy districts of

Eastern North Carolina. Thus, Mr. James McDonald, who had charge of the fifty or sixty laborers who were engaged, during the summer of 1853, in constructing that portion of the Wilmington and Manchester railroad, which crosses Eagles Island, opposite to Wilmington, informs me that they were remarkably healthy, no one of them losing more than two or three days, during the entire period they were engaged in this work. The line of road, he says, was sixty feet wide, and passed along cypress swamps and old neglected rice fields with a deep alluvial soil, over which heavy fogs would settle every night, completely drenching the clothes of the workmen, most of whom would go out and sleep upon the cross ties of the road, so that in the morning, when called up, their clothes would be as wet as though they had been in the rain. In this condition, these men, who were mostly foreigners, and who were spending their first summer at the south, would begin their work, and prosecute it through the long summer days, under the sickening influence of a southern sun, and yet there was not a single case of ague and fever among them.

Dr. Satchwell thinks the escape of the workmen from sickness, while engaged in ditching and canaling our public lands, was owing to the great amount of water in the soil, before the "canals were completed from Pungo and Alligator Lakes to their outlets in Pungo river and Rutman's creek." Now, this cannot

be, for two very simple but very obvious reasons.— In the first place, it is notoriously true that some of these lands, before these ditches and canals were begun, and certainly during the period in which the work was prosecuted, would become so exceedingly dry as to take fire and burn up, from the great amount of woody matter, and even logs of timber, which were underlying the soil. These fires would generally commence with the burning of a stump, which would convey the destructive element below the soil, to the underlying stratum of combustible materials, in such a state of perfect dryness as to be readily ignited. In the second place, there was allowed sufficient drainage to the canals and ditches, as they were cut, to prevent the accumulation of water in them to such extent as to interrupt the progress of the work. This alone, considering the great tendency to extreme dryness, on many portions of these lands, would sufficiently drain them, not only to prevent the water from springing “into and around your boots by a very moderate pressure on the spongy surface, though apparently dry,”* but also afford plentiful exhalations from the vegetable matter in the soil, under the drying influence of the hot months of summer and autumn, after it had been previously soaked in water during the entire winter and spring. Besides, the immense upturning of rich earth, necessarily effected by the digging of these canals, which

* Dr. Satchwell.

had never been previously exposed to the sun's rays, ought, according to the teachings of the miasmatists, during the hot months of summer and autumn, to be a fruitful source of febrile miasms. Upon this subject, Lind says: "The effluvia from ground newly opened, whether from graves or ditches, are far more dangerous than those from the same swampy soil, where the surface is undisturbed."

I have now finished my remarks in reply to Dr. Satchwell's strictures on my address, delivered here three years ago; and, although I am conscious of having trespassed too long on your patience, yet I must beg your indulgence for a few moments, while I sum up, in as brief a manner as possible, the heterogeneous and contradictory opinions which have prevailed with some of the highest authorities in medicine, as to the origin of periodical fevers and the laws of marsh miasms.

SUPPOSED ORIGIN OF PERIODICAL FEVERS.

Lancisi, in 1695, ascribed the origin of periodical fevers to *marsh miasm*, which he affirmed, consisted of effluvia of inorganic and animalcular constitution.

Richter, a distinguished German writer, speaks of them as caused by worms and other sources of intestinal irritation; by suppression of the catamenia, and other habitual discharges.

Henry Holland and others believe that these fevers are produced by a host of animalcules which float about in the air.

Elliotson says that an exhalation from decaying vegetable matter is the true indispensable and exciting cause of ague and fever.

Annesly, a writer on the diseases of British India, concludes that the cause is the product of the different elements which are found in rich soils, when acted on by heat, the air and moisture.

Armstrong rejects, altogether, the doctrine of a specific poison in accounting for their origin.

J. K. Mitchell thinks them owing to the injurious and poisonous action of the sporules of fungi, which are disseminated through the air.

Ferguson denies the necessity of *vegetable decomposition* to produce these diseases, but attributes them to the rapid evaporation of water in an arid soil.

Dr. Watson declares that the primary exciting cause of intermittent and remittent fevers, without which ague would never occur, is a specific poison, producing specific effects on the human body.

Tolloch thinks there does not exist any relationship whatever, as cause and effect, between marsh exhalations and ague and fever.

Dr. Wood admits that periodical fevers may originate without any emanation from vegetable decomposition to poison the atmosphere.

Dr. Bell, of Philadelphia, and Prichett, in his account of the African remittent fever, think that the known and appreciable states of the earth's surface, superincumbent atmosphere, and modes of life, will account for the origin of these fevers.

Boussingault has recently advocated with some zeal the theory that carburetted hydrogen is the active morbid agent in the production of periodic fevers. He detected carbon in the dew of marshes in the department of Ain, and having ascertained that hydrogen ex-

Sir James Murray contends that the true malarious agents are electro-galvanic currents and accumulations.

Professor Daniells, and the Drs. Gardner, of London, and Hampden Sidney College, Virginia, think that the active agent which produces fevers in malarious situations is the *sulphuretted hydrogen* to be found in their waters.

Dr. Gardner admits that this gas is undoubtedly produced wherever vegetable matters are undergoing putrefaction; but contends that "those circumstances which augment and even produce malaria, (as in the Ligurian marshes and those of South Carolina,) are in no

isted in the same situations, he concluded that carbon existed there as carburetted hydrogen.

Fordyce in his discourses earnestly supports the opinion that moisture is the main agent in the production of diseases, and considers Holland and Batavia striking instances to prove it.

The celebrated Roman Physician Folchi, who had bestowed much time and attention upon this subject, thought that moisture, dampness, and the chilling effects of the dews of night, and not miasmata, produced these diseases.

Lancisi states that the

way concerned in the development of carburetted hydrogen gas." He thinks "the most dangerous sites are where sea water finds access to marshes."

Tullock thinks moisture cannot be the cause of disease, else British Guiana, where there is twice as much rain as in Jamaica, would be more sickly than the latter place, whereas it is twice as healthy.

Murray, British Inspector General of Hospitals, avers that fevers, every way analogous to those to be found on marshy plains, frequently result from the application of intense solar or atmospheric heat.

Wortabet, in his fevers

purest breezes, *tametsi saluberrimus*, no matter from what quarter they may blow, are adequate to produce an attack of periodical fever.

Dr. Heyne accounts for the occurrence of these diseases amongst the rocky, wooded hills of the Madras Presidency, by supposing them to be owing to some magnetic influence, dependent upon the ferruginous character of the rocks.

The celebrated Linnæus contended, in his Inaugural Essay, that periodical fevers originated in all those places where the soil abounds in clay, and only in such places; whilst Fodere, in his classification of insalubrious localities, places the clayey soil

of Syria, says that inattention to personal cleanliness, filth and poverty, independent of any marsh effluvia, will produce intermittent fever.

Von Aenvank, a celebrated Netherlander, accounts for their prevalence in argillaceous soils, by supposing that clay possessed the property of absorbing oxygen from the atmospheric air, and thus impairing its purity.

Dunglison, contesting the views of Fodere, says: "It certainly cannot be maintained by any one who has inspected the soils of malarious regions, that the clayey soil is most insalubrious next to the marshy and turfy.—Some of the most healthy

next to that of marshes and turbaries.

districts are found of this soil, and on the other hand, as we have previously seen, some of the most unhealthy are sandy."

Fourcault thinks these fevers depend on the occurrence of three essential conditions, moisture of the air, elevation of temperature, and atmospheric vicissitudes.

Dr. Foster is of opinion that it is not the heat, nor cold, nor dampness, nor drought of the air, nor sudden changes, which is chiefly concerned in producing disorders, but the inexplicable peculiarity of its electrical state.

The laity, like the profession, from the early teachings of the miasmaticists, as well as from the force of habit, have been accustomed to believe that periodical fevers are produced by an emanation from decaying vegetable matter, as a formal and specific cause which is essentially the same, and in-

Dr. Merrill says, in his lecture before the Memphis Medical Society : "The subject of the causation of fever, independent of decaying influence, has of late years gained such importance, however, that few treatises are now written upon this disease, without advert- ing to it, although most

variable in all countries and situations.

of what we find in our *new* books, upon the subject of fevers, is taken from the *old* ones."

"We believe," says the British and Foreign Medico-Chirurgical Review, "that we are as yet *in utter ignorance* of the agent or agencies represented by the conventional term *malaria*, or marsh poison."

"The doctrine of a specific poison," says the American Journal of the Medical Sciences, "generated during the slow decomposition of vegetable matter, as a cause of fever, is fast losing ground—as the etiology of endemic and epidemic diseases is more closely and systematically investigated."

I shall now mention some of the opinions of different authors as to the causes and conditions which are said to affect and control this supposed poison, marsh miasm, and I think we shall find here as many discrepancies as were exhibited on the subject of the origin of periodical fevers.

CHARACTERISTICS OF MARSH MIASM.

Sir Gilbert Blane states that the people in the villages *in the midst of the*

Ferguson says that the troops were sickly "whenever, during the hot sea-

fens, were in general healthy at a time when the fever was prevailing in the more elevated situations of Lincolnshire.

Monfalcon states that miasmata during the warmer and more heated hours are elevated to great heights in the atmosphere, and may thus be carried to, and deposited on, distant hills and mountain ridges.

According to the opinions of Tournon, Carriere and others, an elevation of from five to seven hundred feet will place one beyond the influence of miasmata, no matter what may be the nature of the localities at the base of such situations.

son any portion of the army was obliged to occupy the arid encampments of the level country, which at all other times were healthy, or at least unproductive of endemic fever."

Ferguson alleges that it is heavier than air, has a peculiar attraction for the soil, and therefore cannot mount upwards, but creeps along the ground, whenever it strays away from the source of its origin.

Major Tulloch does not believe that an elevation of six or seven hundred feet will ensure one against the assaults of the cause of periodical fever, whatever it is, but goes far beyond that, and thinks an elevation of not less than 2,000 or 3,000 feet will do it.

On the coast of Batavia, according to Sir John Lind, so little attraction had water for it, the malaria was wafted out to vessels riding at anchor some five or six miles from the shore.

Sir John Pringle affirms that the ground-floors of the houses where the malaria is disengaged are most sickly, and Ferguson and others agree with him that it is less deadly as it is more distant from the source of its origin.

Parent Duchatelet, a celebrated physician of Lyons, after several years investigation, came to the conclusion that water, in which hemp or flax had been rotted, was not in-

In the narrow straits of Holland, only a few yards from shore, Sir Gilbert Blane says none of the seamen were affected by the disease which was so fatal to the land forces, so great is the attraction of water for malaria.

Monfalcon declares that as the malaria is carried upwards it becomes more energetic, and McCulloch agrees with him, and says that the source of its origin is frequently left perfectly salubrious, whilst distant hills and situations are rendered pestilential by it.

Brachet, another distinguished physician of Lyons, gives it as his decided opinion that the readiest and most certain method of converting a healthy village into a hot

jurious to the health of those who drank it, and that the emanations from it were not unhealthy. bed of intermittent fevers, is to furnish it with ponds and steep hemp in them.

According to the prevailing opinion, it is only to be found where there are marshes, stagnant pools, swamps, or wet rich grounds.

Dr. Jas. Johnson says that the same malaria arises from the summits of the mountains in Ceylon, which is found on the marshy plains of Bengal.

Dr. Dickson, of Charleston, S. C., a popular writer of this country, says: "A very dry summer and spring are apt to be healthy," and Folchi and others agree with him.

Dr. Macmichael says, Trichori, in the Gulf of Volo, in Greece, a dry limestone rock, is notorious for its malaria, which is likewise true of one of the Isles de Loss, according to Boyle.

McCulloch asserts that in every instance where it is found on the hills and mountain ridges, it always arises from the wet ground at their base, or at no very great distance off.

Ferguson says: "a year of stunted vegetation, through dry seasons and uncommon drought, is infallibly a year of pestilence to the greater part of the West India Islands.

Robert Jackson says: Fodere, speaking of this matter, says the shores and vicinity of large rivers, lakes and the sea are generally healthy, unless where there is an admixture of salt with fresh water.

“The usual endemic of warm climates is less frequent and formidable on the banks of rivers, after their waters become mixed with the sea, than before this has happened.”

Folchi thinks a hot, dry summer most exempt from fevers; and the most sickly one is when falls of rain alternate with atmospheric vicissitudes of temperature.

Dr. Joseph Brown asserts he has seen plenty of ague and fever in parts of Estremadura, when everything was parched up for want of rain, and where no visible dampness could be supposed to have a share in their production.

M. Julia ascribes it to a union of animal and vegetable putrifaction; and Dr. James Johnson thinks, generally speaking, it is the product of animal and vegetable decomposition, by means of heat and moisture.

Dr. Jos. Brown says: “Malaria is generated in so many instances in which animal matter does not exist, that we must conclude that the presence of such matter is not essential to the formation of the poison.” Dunglison and others agree with him in this opinion.

Copland, in his Dictionary of Practical Medicine, says: "In warm countries or in hot seasons in temperate climates, the places which are most productive of malaria generally, also abound the most in animal substances undergoing decomposition;" again, "I have always considered the number of insects and reptiles with which a place abounds as more indication of its insalubrity than almost any other circumstance."

Dr. Gardner attempts to account for the absence of malaria from certain marshes, viz: those around Boston, and the bogs of Ireland, and the marshes of Scotland—by suppos-

Armstrong says, Kingston, in the Island of St. Vincent, having all the elements for the production of this poison, for it abounds in as much vegetable matter, and "reptiles, and insects, and other animal matter as is found in other tropical countries, is yet as healthy as the most favorable spot in England." New Amsterdam, Berbice, and other places in the West Indies, are similarly situated, according to Ferguson; while Dundas informs us that such is the case with Bahia, Bomfim and other places in Brazil.

Most other writers endeavor to account for the exemption from the malaria enjoyed by the bogs of Ireland and the marshes of Scotland and some marshes in other coun-

ing that iron, or zinc, or some other metals exist in the sub-soil, and that these by uniting with the sulphur, prevent the development of sulphuretted hydrogen. McCormac thinks the absence of sufficiently high and continued heat is the reason Ireland is exempt from periodic fevers.

Forsythe, Ferguson, Sir John Pringle, Sir Charles Morgan and others, contend that a dry road, or a wall, or a belt of trees will arrest the progress of this poison. And Watson thinks a moat (perhaps) round a house will stop it.

Sir John Pringle, Fordyce and Ferguson, declare that the dry sandy plains of South Holland, Dutch Brabant and Flanders, without trees, were pestilential to the British forces.

tries by supposing that the vegetable matter in them is in a subcarbonized state, and therefore does not give off miasmatic exhalations. This is the supposition of Weld, Craigie Watson and others about the Dismal Swamp, but it is a mistake.

Monfalcon, McCulloch, Brown and others say it will mount into the higher regions of the air, and be disseminated over the adjacent country, despite the intervention of walls, cliffs, woods and secondary ridges.

Heber says the wood tracts of Nepaul and Malwa, having neither swamps nor perceptible moisture, are uninhabitable in summer and autumn by man, beasts, or birds, from their pestilential character.

The miasmatists, generally, believe that the dews of insalubrious localities are loaded with the miasmatic principle, which has been brought down and precipitated with the aqueous vapor of the atmosphere.

Sir John Pringle and others assert that this poison is connected with a most noisome and dreadful smell.

The prevailing opinion among the miasmatists is that it is not contagious, though some believe it is capable of hereditary transmission.

Fordyce, Sir John Lind, Dr. Dundas, the French

Dr. Minzi, of the Central Hospital, Terracina, with the view of testing this matter, together with others, drank freely of the dews of such localities besides washing abraded surfaces and the sores of peasants with it, without evil effects.

Ferguson says a most noisome and disgusting odor, arising from the decomposition of vegetable matter, pervades the town of New Amsterdam, Berbice, but it does not produce disease.

Bailly and Audouard, in France, and Cleghorn, Fordyce and Brown, in Great Britain, think that it is communicable by contagion.

Those who advocate the abstract theory that

Algerian Surgeons, and marsh miasm is the cause of periodical fevers, deny that ague and fever, and continued fever, are mutually convertible.

These are some of the varying features and contradictory statements, which are furnished by the medical history of this imp of the marshes. I shall not attempt to reconcile such discordant elements. But if you should think I have placed too much importance upon these conflicting opinions, I have only to say, that I have brought them forward in this connection as a proper argument, because such differences cannot be explained as resulting from one primary, specific, and indivisible cause, without bidding defiance to the established principles of correct reasoning, and the plainest dictates of common sense.

Before concluding, as I understand it is expected of me, I will, in as few words as possible, endeavor to give you an idea of my own views upon this subject. I regret that the daily business pursuits of a laborious profession have not allowed me the time and opportunity thoroughly to investigate and elaborate my opinions. But, whatever of observation, and reflection, and reading I have been able to bestow upon this matter, have brought me to the conclusion that endemic fevers are natural occurrences, chiefly incident to particular localities, and must be accounted

for on the principle of natural causes. And that atmospheric disturbances, such as the variations of temperature, by whatever means effected, but as manifested more particularly by the varying degrees of heat during the different hours of the day, and in the night-time, in the same locality, and at the same season of the year; hygrometrical influences, atmospheric pressure, electrical tension and states of the air and earth's surface, as affected by the foregoing enumerated conditions of the atmosphere, and upward radiation of heat, especially at night, are the exciting causes of periodic fevers, of which intermittents are, in my opinion, the primordial type. On the other hand—want of light, want of ventilation, impure air and noxious vapours, from whatever source arising; scanty diet, impure food, inattention to personal cleanliness, want of comfortable quarters, over-exertion, dissolute habits, an irregular and artificial mode of life, by enervating and otherwise spoiling the natural tone and healthy vigor of the system, become predisposing causes, rendering it more or less liable to be affected by the exciting cause.

P. S. Since the above was written and delivered, I have seen and carefully read the recent very learned and elaborate work by R. La Roche, M. D., of Philadelphia, on "Pneumonia, its supposed connection, pathological and etiological, with autumnal fev-

ers; including an inquiry into the existence and morbid agency of malaria;" but it has failed to convince me, as I think it will every honest and unprejudiced inquirer after truth, of the existence of a specific gaseous poison, emanating under certain circumstances of heat and moisture, from the decomposition of organic substances. On the contrary, if it proves anything, it proves too much, and *quod probat nimis, probat nihil*, is a wise maxim, which, when applicable, should be fatal to any effort, whether made for the purpose of laying down the important facts and elucidating the great principles of a correct theory of causation, or for the establishment of truth before a tribunal of justice.

Dr. La Roche believes that this poison is of a vegeto-animal nature, not an evolution from vegetable decomposition singly, nor from animal putrefaction alone, although he does not, by any means, assert that emanations from either of these sources will not produce autumnal fevers; nor, in fact, that they may not be of cyptogamous, or animalcular origin; whilst he distinctly admits that not only yellow fever, but typhoid fever, and even oriental plague are malarial diseases, although he scouts the idea of their pathological identity.

Indeed, the author does not call upon us to render our assent to the demonstrable existence of a distinct appreciable *gaseous entity*, possessing specific poisonous properties, and proceed to prove this pro-

position, but we are required to admit the existence of an aeriform poison of mixed "composition and nature"—a *variety of miasms*—which, although inappreciable in themselves, he says, following Lancisi and others, are capable of producing a "great diversity of effects" according to their difference "materially in composition and nature." Thus, at one time, believing "that miasmata or exhalations produce different forms of fever," and that "he is justified in the belief, considering the great diversity of effects produced," he does not wish "to be understood as maintaining that those exhalations are always identically the same in their nature;" for "the malignant forms of such diseases (periodical fevers) are never produced by the effluvia of genuine marshes, but are the products of other miasmatal sources; while, on the contrary, fevers known to arise from marsh exhalations, are never produced by the effluvia which occasion *the other forms of the disease*." At another time, alluding to this miasm, familiarly spoken of everywhere in this work as a poison, and supposed by the author to be of a vegeto-animal origin and nature, he declares, "that it possesses an *individuality* of its own, and serves by its poisonous properties to render the air of localities where it is generated or conveyed, insalubrious, and a fruitful source of fever."

Now, if we urge these premises to their legitimate conclusions, we shall necessarily have, for the

milder intermittents and remittents, and for the more malignant forms of those diseases, and for yellow fever certainly, and typhoid and typhus fevers, and even oriental plague, perhaps, a separate, formal, and specifically poisonous aeriform cause, each of which, although it is, in his opinion, of vegeto-animal nature and composition, "possesses an individuality of its own, and serves by its poisonous properties to render the air of localities where it is generated or conveyed, insalubrious, and a fruitful source of fever." And thus we may have, according to Dr. La Roche, aeriform causes of disease, each differing from the other and specifically poisonous, but all of a vegeto-animal essence, existing together in the same atmosphere, as we sometimes have the mildest and the most malignant forms of intermittent and remittent fevers, and even yellow and continued fevers, prevailing in the same locality at the same time. Yet, notwithstanding all this, it is certainly true that he has not been able to establish by just and proper inference even, much less by demonstration, either the existence or the nature and essence of any one of these causes; or to lay down the circumstances which certainly produce them, or the primary laws which they obey, or the mode in which they produce those symptoms we have empirically determined fever.

Again, when denying the etiological value of the abnormal states of the atmosphere, in producing au-

tumna and yellow fever, he says: "We may safely affirm that excessive, great or long continued heat will not do so;"—and that "this want of necessary connection, as cause and effect, between high atmospheric heat and fever—common autumnal and yellow—has been pointed out by a large number of writers on these diseases, as they show themselves in various parts of the globe;" while in another place, speaking of malarial fever, he remarks: "It is emphatically a disease of hot weather, requiring for its production a continuance, for some time previous, of high atmospheric heat. It appears, generally, some weeks after the hottest month, the period being retarded as we proceed North. For the same reason it may readily be understood to be a disease of hot latitudes, prevailing as it does violently and almost perpetually within the tropics, and ceasing long before we reach the polar circle."

And so, speaking of fever on the African coast, he says: "It is at this period (the hottest of the year,) that remittent fevers usually make their appearance. In the west Indies, the period of the greatest liability is between July and December, when the hottest weather combined with considerable moisture, prevails." And in treating of the fevers of Ceylon and Bengal, he declares that: "In a word, the epoch of appearance may vary in different localities, according to the situation of those, and their position relative to the equator, and the consequent modification

of the period of the seasons; but everywhere endemic or autumnal fevers break out or are most rife during or shortly after the hottest weather." But notwithstanding all these admissions on the part of Dr. La Roche, as to the agency of heat, or heat combined with moisture, as the necessary cause of fevers, "common autumnal and yellow," he nevertheless thinks we may safely affirm that excessive, great or long continued heat will not account for them, and that heat and humidity combined are "not the efficient cause of fever."

With regard to the influence of winds in the production of fevers he is equally imprecise and unsatisfactory. In one place he quotes Dr. Bone to prove that yellow fever "prevails in Brimstone Hill, St. Kitts, when the strong winds that have swept foul ground on mount Misere, impinge upon the persons in the ill-constructed barracks and out buildings on that hill;" whilst in another place, he asserts the direct morbid action of winds without the circumstance of their passing over "foul ground" when he says: "and in Tobago, Dominica, Grenada, St. Vincent, and on all the hilly, uncleared islands of the West Indies, strong north and east winds, impinging upon the troops and their families, in ill-constructed barracks, are causes of disease."

Again, he quotes with decided approbation, the strong and unequivocal testimony of Lefort, to prove the morbid influence of certain winds, in producing

yellow fever where there is no agency of foul exhalations expressed or implied even in their causative action.

Thus Lefort says: "The development of the yellow fever, in the West Indies, in a great number of men at the same time, in different parts, at a distance from each other, on a level with the sea or slightly above, on board vessels at port or at sea, coincides so exactly with the prevalence of the south winds, that it is impossible not to recognize in these meteorological conditions the true cause of the epidemic of yellow fever. The effect here is intimately and necessarily connected with its cause. The production and extension of yellow fever under the prolonged influence of the south winds, is a fact observed by every one; so inevitable, indeed, that it can be predicted without fear of being ever mistaken. This action of the south winds is felt here by every thing that breathes. They produce undefinable effects on our senses. We feel them in bed, or sitting at the desk; they enervate, cause oppression, and distress the spirits. To say in what these atmospherical alterations, the effects of which are so much to be dreaded, consist, and to seek to determine their specific nature, is, doubtless, a task beyond the faculty of man."

Notwithstanding, therefore, the very extensive survey of facts and authorities, which have been

brought forward in this connection by Dr. La Roche, and which unquestionably will prove quite a lift for the lazy, it would not be, I conceive, a very difficult task to point out many illogical conclusions and inconsistencies in this work, which have resulted, no doubt, from hasty generalization, in attempting to square facts with preconceived opinions, or from a total forgetfulness in one place of what had been said in another; but this is neither the time nor place to enter upon such a work.

To the term malaria there can be no particular objection, when used merely to convey an impression of the *morbific state* of the atmosphere of certain localities. But it is a different thing when employed by the school-men as a familiar expression, representing a distinct gaseous entity, possessing essential properties, specifically poisonous in their nature, since neither the existence of the gas, nor its composition, nor qualities, can be appreciated by our senses in their natural state, nor aided by all the contrivances which science and ingenuity can suggest, nor traced even by the presence of those agencies which are said to be capable of generating it; for Dr. La Roche admits, "that fevers prevail sometimes even in arid places with want of surface water, where the soil is rocky, or sandy, parched, and deficient in vegetation and where, in a word, circumstances generally are, in appearance at least, unfavorable to the decay of organic matter." And then, again, that: "It not un-

frequently happens that in localities where, from the character of the soil, or the nature and condition of the substance by which the surface is covered, as well as from the heat and moisture of the climate, febrile complaints might be expected to occur, they are, nevertheless, seldom or never encountered."

Furthermore, whilst contending that "occurrences on shipboard prove the agency of malaria," he not only admits the difficulties which surround his position, but, as I think, almost, if not quite surrenders the main question; for he declares that "all vessels containing vegetable and other matters in a state of incipient or decided decomposition, lying in southern ports or navigating southern waters, even in warm weather, are not all expected to suffer from fever," because the "sources of vegetable and other decomposition on board of ships, are under the control of some of the same agencies, which, as we have seen, modify the effects of like sources of contamination on land. They require, before they can generate fever, to be acted upon by high atmospherical heat; that this heat should continue a certain length of time; that the season should be that in which the fever usually prevails; and that there should exist a suitable epidemic constitution of the atmosphere. Remove all these contingencies, and foul ships will generally be found to remain healthy." In the same manner, and with equal earnestness, he had before insisted "that some marshy surfaces" and "sources of vege-

table and other decomposition" on land "prove completely, or to a great extent, innocuous in certain seasons, and even during a succession of years," because the effluvia from them are harmless unless aided by high and long continued heat ; a certain hygrometrical condition ; the season of the year when these diseases usually prevail ; and a suitable epidemic constitution of the atmosphere. What a theory of causation ! In the first place, he assumes the existence of a cause, an indispensable something, with neither appreciable qualities, nor capable of demonstrable being ; yet, without which, as he assures us, periodical fever could not exist. And then, in the second place, finding himself unable by this means to solve the certain difficulties, which arise on either hand demanding an explanation, he claims the presence and aid of a series of contingencies, most of them palpable facts or appreciable agents. Thus, in violation of all the just rules of philosophizing, he superadds a hypothetical to known causes, which known causes other etiologist in a more philosophic spirit believe of themselves capable of producing these diseases ; while the absence of any one of them, especially the last, itself an unknown condition of things, may render Dr. La Roche's whole theory a baseless fabric, and this *primum mobile et causa sine qua non* totally inoperative, and therefore a nonentity, since it is only by its supposed effects that he even assumes to know certainly of its existence.

In this view of the subject, it seems to me to become one of those instances of faulty reasoning so graphically described by Locke, in his great work on the human understanding, when speaking of the use of terms, purely conventional, arbitrary, and without definite meaning, by the Peripatetics, Platonists and Epicureans. "There is," he remarks, "scarce any sect in philosophy that has not a distinct set of terms, that others understand not; but yet this gibberish, which, in the weakness of human understanding, serves so well to palliate men's ignorance and cover their errors, comes, by familiar use among those of the same tribe, to seem the most important part of language, and of all others the most significant.— And should aerial and ethereal vehicles come once, by the prevalence of that doctrine, to be generally received anywhere, no doubt those terms would make impressions on men's minds, so as to establish them in the persuasion of the reality of such things, as much as peripatetic forms and intentional species have heretofore done."

However, I must acknowledge, from the great learning which Dr. La Roche has displayed, in the careful and painstaking collocation of facts and authorities, under the different heads of inquiries and subdivisions of the main subject, systematically instituted by him, that he has indissolubly connected his name with the medical literature of malaria, besides

furnishing those who have not the time or inclination to study out this question for themselves, an easy and agreeable acquaintance with those eminent medical men who have written upon this subject.

THE END.





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